Final Restoration Plan for the Anadromous Fish Restoration Program

A Plan to Increase Natural Production of Anadromous Fish in the Central Valley of California

Released as a Revised Draft on May 30, 1997
and Adopted as Final on January 9, 2001

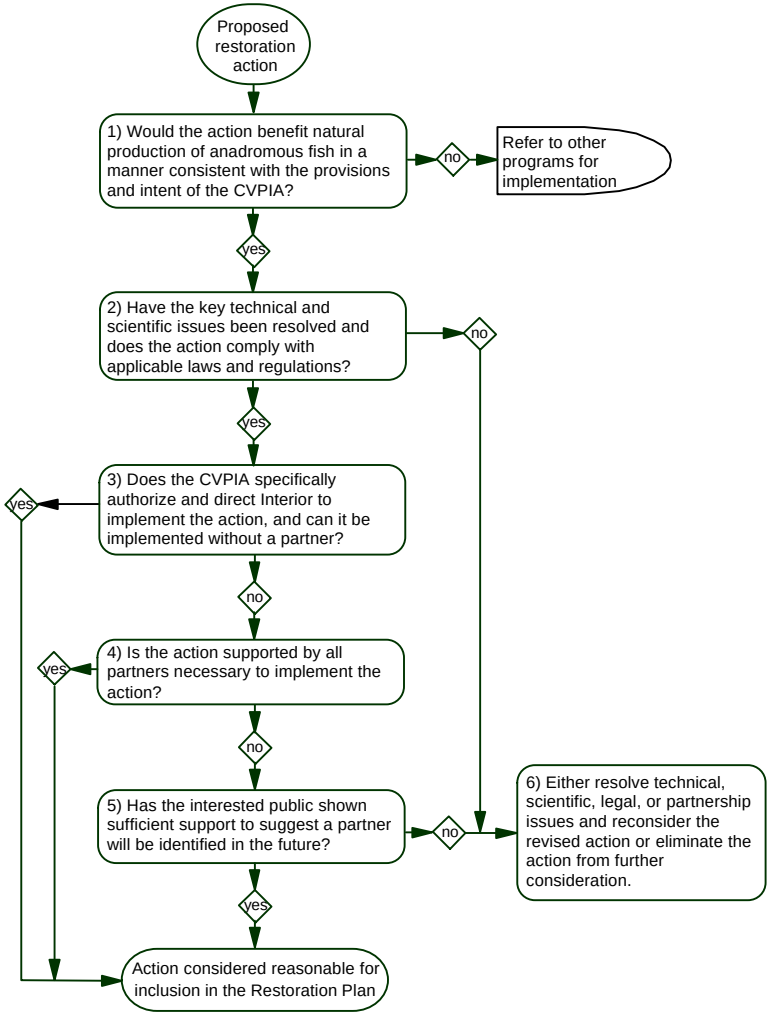

Figure 1. Process used to identify reasonable restoration actions for inclusion in the Restoration Plan (see explanation in text).

October 1993 October-November 1993 March 1994 May 1994 May 1994 July 1994 July 1994 August 1994 October 1994 May

SACRAMENTO RIVER BASIN

Upper mainstem Sacramento River

High priority

<table>
<tr><th>Action</th><th>Involved parties</th><th>Tools</th><th>Priority</th></tr>
<tr><td>*1. Implement a river flow regulation plan that balances carryover storage needs with instream flow needs consistent with the 1993 biological opinion for winter-run chinook salmon based on runoff and storage conditions, including the following minimum recommended flows at Keswick and Red Bluff Diversion dams.

Recommended minimum Sacramento River flows (cfs) at Keswick Dam for October 1 to April 30 based on October 1 carryover storage in Shasta Reservoir and critically dry runoff conditions (driest decile runoff of 2.5 maf) to produce a target April 30 Shasta Reservoir storage of 3.0-3.2 maf for temperature control.

<table>
<tr><th>Carryover storage (maf)</th><th>Keswick release (cfs)</th></tr>
<tr><td>1.9 to 2.1</td><td>3,250</td></tr>
<tr><td>2.2</td><td>3,500</td></tr>
<tr><td>2.3</td><td>3,750</td></tr>
<tr><td>2.4</td><td>4,000</td></tr>
<tr><td>2.5</td><td>4,250</td></tr>
<tr><td>2.6</td><td>4,500</td></tr>
<tr><td>2.7</td><td>4,750</td></tr>
<tr><td>2.8</td><td>5,000</td></tr>
<tr><td>2.9</td><td>5,250</td></tr>
<tr><td>3</td><td>5,500</td></tr>
</table>
</td><td>USFWS, USBR, NMFS, CDFG, Tehama-Colusa Canal Authority (TCCA)</td><td>3406(b)(1)(B), 3406(b)(2), 3406(b)(3)</td><td>High</td></tr>
</table>

Action	Involved parties	Tools	Priority
*2. Implement a schedule for flow changes that avoids, to the extent controllable, dewatering redds and isolating or stranding juvenile anadromous salmonids, consistent with SWRCB Order 90-5.	USFWS, USBR, CDFG, SWRCB, NMFS	3406(b)(9)	High
*3. Continue to maintain water temperatures at or below 56EF from Keswick Dam to Bend Bridge to the extent controllable, consistent with the 1993 biological opinion for winter-run chinook salmon and with SWRCB Order 90-5.	USFWS, USBR, CDFG, SWRCB, NMFS	3406(b)(1)(B)	High
*4. Continue to raise the gates of the Red Bluff Diversion Dam (RBDD) for a minimum duration from September 15 through at least May 14 to protect adult and juvenile chinook salmon migrations, consistent with the 1993 biological opinion for winter-run chinook salmon and with SWRCB Order 90-5, and accommodate water delivery using appropriate pumping facilities.	USFWS, USBR, SWRCB, NMFS, CDFG, TCCA	3406(b)(6)	High[3]
*5. Construct an escape channel for trapped adult chinook salmon and steelhead from the Keswick Dam stilling basin to the Sacramento River, as designed by NMFS and USBR.	USFWS, USBR, NMFS, CDFG	3406(b)(11)	Medium
*6. Continue to implement the Anadromous Fish Screen Program.[4]	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	High[5]

[3]Although Action 4 addresses fish passage, it was assigned high priority because it significantly increases fish productivity. These findings are based on unpublished data and reports located in the Northern Central Valley Fish and Wildlife Office, USFWS, Red Bluff, California (Rich Johnson, personal communication 1995).

[4] Priorities for screening are being determined by the Anadromous Fish Screen Program.

[5]Although Action 6 addresses fish passage, it was assigned a high priority because it has a high potential to significantly increase fish production.

Action	Involved parties	Tools	Priority
*7. Implement structural and operational modifications to the Glenn-Colusa Irrigation District's (GCID) water diversion facility to minimize impingement and entrainment of juvenile salmon.	GCID, USFWS, USBR, CDFG, NMFS, CDWR	3406(b)(20)	High[6]
*8. Remedy water quality problems from toxic discharges associated with Iron Mountain Mine and water quality problems associated with metal sludges in Keswick Reservoir, consistent with the Comprehensive Environmental Response, Compensation, and Liability Act and the Clean Water Act.	USEPA, SWRCB USFWS, USBR, NMFS, CDFG		High
*9. Pursue opportunities, consistent with efforts conducted pursuant to Senate Bill 1086 (SB 1086), to create a meander belt from Keswick Dam to Colusa to recruit gravel and large woody debris, to moderate temperatures and to enhance nutrient input.	Upper Sacramento River Fisheries and Riparian Habitat Advisory Council (USRFRHAC), CDFG, COE, USFWS, USBR, CDWR, NMFS	3406(b)(1)(B), 3406(b)(13)	High

[6]Although Action 7 addresses solutions to impingement and entrainment of juvenile salmon, it was assigned a high priority because solutions can significantly enhance fish production on the upper mainstem Sacramento River.

Action	Involved parties	Tools	Priority
*10. Implement operational modifications to Anderson-Cottonwood Irrigation District's (ACID) diversion dam to eliminate passage and stranding problems for chinook salmon and steelhead adults and early life stages; eliminate toxic discharges from the canal and implement structural modifications to improve the strength of the fish screens.	ACID, USFWS, USBR, CDFG, RWQCB, NMFS	3406(b)(17)	Medium
*11. Develop and implement a program for restoring and replenishing spawning gravel, where appropriate, in the Sacramento River.	CDFG, USFWS, USBR, NMFS, CDWR	3406(b)(13)	High

Evaluation	Involved parties	Tools	Priority
*1. Continue study to refine a river regulation program, consistent with SB 1086, that balances fish habitats with the flow regime and addresses temperatures, flushing flows, attraction flows, emigration, channel and riparian corridor maintenance.	USFWS, USBR, CDFG, SWRCB, NMFS, USRFRHAC	3406(e)(1)	High
*2. Evaluate opportunities to incorporate flows to restore riparian vegetation from Keswick Dam to Verona that are consistent with the overall river regulation plan.	USFWS, USBR, NMFS, CDFG, USRFRHAC	3406(b)(13), 3406(e)(1)	High
*3. Continue the evaluation to identify solutions to passage at RBDD, including measures to improve passage when the RBDD gates are in the raised position from September 15 through at least May 14.	USFWS, USBR, CDFG, TCCA, NMFS	3406(b)(10)	High

Evaluation	Involved parties	Tools	Priority
4. Evaluate the contribution of large woody debris and boulders in the upper mainstem Sacramento River to salmonid production and rearing habitat quality.	CDFG, USFWS, USBR, CDFG, RWQCB, NMFS	3406(e)(6)	Medium[7]
*5. Identify opportunities for restoring riparian forests in channelized sections of the upper mainstem Sacramento River that are appropriate with flood control and other water management constraints.	USRFRHAC, The Nature Conservancy (TNC), CDFG, COE, USFWS, USBR, CDWR, NMFS	3406(b)(13)	High
*6. Identify and attempt to maintain adequate flows for white sturgeon and green sturgeon from February to May for spawning, emigration, egg incubation and rearing, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	USFWS, USBR, NMFS, CDFG	3406(b)(1)(B), 3406(b)(2), 3406(b)(3)	High
*7. Identify and attempt to maintain adequate flows from April to June for spawning, incubation, and rearing of American shad, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	USFWS, USBR, NMFS, CDFG	3406(b)(1)(B), 3406(b)(2), 3406(b)(3)	High

[7]Although Action 4 contributes to natural habitat, it was assigned medium priority because of a lack of evidence of benefits to fish production.

Evaluation	Involved parties	Tools	Priority
8. Identify and implement actions that will maintain mean daily water temperatures between 61EF and 65EF for at lease one month between April 1 and June 30 for American shad spawning below RBDD, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	USFWS, USBR, NMFS, CDFG	3406(b)(2), 3406(b)(3)	High
9. Identify the extent of entrainment of juvenile sturgeon at diversions and pumps and minimize entrainment, if substantial.	USFWS, USBR, CDFG, NMFS		Medium
*10. Identify green sturgeon spawning sites and evaluate the availability, adequacy and use by adult sturgeon.	USFWS, USBR, CDFG, NMFS		High
11. Determine the effects of poaching and fishing on the number of spawning sturgeon.	USFWS, USBR, CDFG, NMFS		Low

Upper Sacramento River tributaries

- Clear Creek High priority

Action	Involved parties	Tools	Priority
*1. Release 200 cfs October 1 to June 1 from Whiskeytown Dam for spring-, fall- and late fall-run chinook salmon spawning, egg incubation, emigration, gravel restoration, spring flushing and channel maintenance; release 150 cfs, or less, from July through September to maintain #60EF temperatures in stream sections utilized by spring-run chinook salmon. Both releases should be within the average total annual unimpaired flows to the Clear Creek watershed.	CDFG, USFWS, USBR, SWRCB	3406(b)(12)	High
*2. Halt further habitat degradation and restore channel conditions from the effects of past gravel mining.	CDFG, USFWS, USBR, BLM, Western Shasta Resource Conservation District (WSRCD), NPS NRCS	3406(b)(12)	High
*3. Remove sediment from behind McCormick-Saeltzer Dam and provide fish passage, either by removing the dam or improving fish passage facilities.	McCormick-Saeltzer Dam owners, CDFG, USFWS, USBR, NRCS, WSRCD	3406(b)(12)	High[8]

[8]Although Action 3 address fish passage, it was assigned a high priority because implementation of other high priority actions in Clear Creek are dependent on completion of fish passage facilities over McCormick-Saeltzer Dam.

Action	Involved parties	Tools	Priority
*4. Develop an erosion control and stream corridor protection program to prevent habitat degradation due to sedimentation and urbanization.	CDFG, USFWS, USBR, NRCS, BLM, WSRCD	3406(b)(12)	High
*5. Replenish gravel and restore gravel recruitment blocked by Whiskeytown Dam.	CDFG, USFWS, USBR, BLM, WSRCD	3406(b)(13)	High
*6. Preserve the productivity of habitat in the Clear Creek watershed through cooperative watershed management and development of a watershed management analysis and plan.	CDFG, USFWS, USBR, BLM, WSRCD		High

Evaluation	Involved parties	Tools	Priority
*1. Evaluate the feasibility of reestablishing habitat for spring-run chinook salmon and steelhead; including ensuring that water temperatures five miles downstream of Whiskeytown Dam do not exceed upper temperature limits for each of the life history stages present in the creek from June 1 to November 1, #60EF for holding of prespawning adults and for rearing of juveniles, and #56EF for egg incubation.	CDFG, USFWS, USBR	3406(b)(1)(B), 3406(b)(7), 3406(b)(12)	High

- Cow Creek

Action	Involved parties	Tools	Priority
1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to provide flows for suitable passage and spawning for fall-run chinook salmon adults and adequate summer rearing habitat for juvenile steelhead.	Diverters, CDFG, USFWS, USBR, SWRCB	3406(b)(3)	High
*2. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
*3. Improve passage at agricultural diversion dams.	Diverters, CDFG, USFWS, USBR		Medium
*4. Fence select riparian corridors within the watershed to exclude livestock.	NRCS, Landowners, CDFG, USFWS, USBR		High

- Bear Creek

Action	Involved parties	Tools	Priority
1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to allow suitable passage of juvenile and adult chinook salmon and steelhead during spring and early fall.	Diverters, CDFG, USFWS, USBR	3406(b)(3)	High

Action	Involved parties	Tools	Priority
*2. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium

- Cottonwood Creek

Action	Involved parties	Tools	Priority
1. Establish limits on instream gravel mining operations by working with state and local agencies to protect spawning gravel and enhance recruitment of spawning gravel to the Sacramento River in the valley sections of Cottonwood Creek.	COE, Shasta and Tehama counties, California Division of Mines, CDFG, USFWS, USBR		High
2. Restore the stream channel to prevent ACID Siphon from becoming a barrier to migration of spring- and fall-run chinook salmon and steelhead.	ACID, Gravel miners, USFWS, USBR		Medium
3. Eliminate adult fall-run chinook stranding by stopping attraction flows in Crowley Gulch or by constructing a barrier at the mouth of Crowley Gulch.	ACID, CDFG, USFWS, USBR		Medium

Action	Involved parties	Tools	Priority
4. Facilitate watershed protection and restoration to reduce water temperatures and siltation to improve holding, spawning, and rearing habitats for salmonids.	Landowners, CDFG, USFWS, USBR		High
5. Establish, restore, and maintain riparian habitat on Cottonwood Creek.	ACID, Gravel miners, Landowners, USFWS, USBR		High

- Battle Creek High priority

Action	Involved parties	Tools	Priority
*1. Continue to allow adult spring-run chinook salmon and steelhead passage above the Coleman National Fish Hatchery (CNFH) weir. After a disease-safe water supply becomes available to the CNFH, allow passage of fall- and late-fall-run chinook salmon and steelhead above the CNFH weir. In the interim, prevent anadromous fish from entering the main hatchery water supply by blocking fish ladders at Wildcat Canyon, Eagle Canyon, and Coleman diversion dams.	CDFG, USFWS, USBR	3406(b)(11)	High[9]

[9]Although Action 1 addresses fish passage, it was assigned high priority because a disease-safe water supply to CNFH substantially enhances production of anadromous salmonids by allowing them unrestricted access to the upper reaches of Battle Creek.

<table>
<tr><th>Action</th><th>Involved parties</th><th>Tools</th><th>Priority</th></tr>
<tr><td>*2. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to increase flows past PG&E's hydropower diversions in two phases to provide adequate holding, spawning and rearing habitat for anadromous salmonids.
<table>
<tr><th>Diversion</th><th>Months</th><th>Flow (cfs)[c]</th></tr>
<tr><td>Keswick ditch[b]</td><td>All year</td><td>30</td></tr>
<tr><td>North Battle Creek feeder [b]</td><td>September-November
January-April
May-August</td><td>40
40
30</td></tr>
<tr><td>Eagle Canyon [a]</td><td>May-November
December-April</td><td>30
50</td></tr>
<tr><td>Wildcat [a]</td><td>May-November
December-April</td><td>30
50</td></tr>
<tr><td>South [b]</td><td>May-November
December-April</td><td>20
30</td></tr>
<tr><td>Inskip [b]</td><td>May-November
December-April</td><td>30
40</td></tr>
<tr><td>Coleman [a]</td><td>September-April
May-August</td><td>50
30</td></tr>
</table>
[a]First phase flows required to support winter- and spring-run chinook salmon between the Coleman Powerhouse and Eagle Canyon Diversion Dams while a disease-safe water supply is being developed for CNFH.
[b]Second phase flows required to support fall-run chinook salmon and steelhead above the CNFH weir, Coleman Powerhouse and Eagle Canyon Diversion Dams, after a disease-safe water supply is available to CNFH.
[c]Flows are intended as indicators of magnitude and subject to revision based on additional analyses.</td><td>CDFG, PG&E, USFWS, USBR, NMFS, FERC</td><td>3406(b)(3)</td><td>High</td></tr>
</table>

Action	Involved parties	Tools	Priority
*3. Construct barrier racks at the Gover Diversion dam and waste gates from the Gover Canal to prevent adult chinook salmon from entering Gover Diversion.	Gover Diversion Dam owners, CDFG, USFWS, USBR	3406(b)(21)	Medium
*4. Screen Orwick Diversion to prevent entrainment of juvenile salmonids and straying of adult chinook salmon.	Orwick Diversion Dam owners, USFWS, USBR, NMFS, CDFG, CDWR, BLM	3406(b)(21)	Medium
*5. Screen tailrace of Coleman Powerhouse to eliminate attraction of adult chinook salmon and steelhead into an area with little spawning habitat and contamination of the CNFH water supply.	CDFG, PG&E, USBR, USFWS	3406(b)(21)	Medium
*6. Construct fish screens on all PG&E diversions, as appropriate, after both phases of upstream flow actions (see Action 1) are completed and fish ladders on Coleman and Eagle Canyon diversion dams are opened.	PG&E, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
*7. Improve fish passage in Eagle Canyon by modifying a bedrock ledge and boulders that are potential barriers to adult salmonids, and rebuild fish ladders on Wildcat and Eagle Canyon diversion dams.	CDFG, USFWS, USBR		Medium
*8. Screen CNFH intakes 2 and 3 to prevent entrainment of juvenile chinook salmon and steelhead.	USFWS, USBR, CDFG, WSRCD	3406(b)(21)	Medium

Evaluation	Involved parties	Tools	Priority
*1. Evaluate the effectiveness of fish ladders at PG&E diversions.	CDFG, PG&E, USFWS, USBR	3406(e)(3)	Medium
*2. Evaluate the feasibility of establishing naturally spawning populations of winter-run and spring-run chinook salmon and steelhead through a comprehensive plan to restore Battle Creek.	CDFG, USFWS, USBR, NMFS	3406(e)(6)	High[10]
*3. Evaluate alternatives for providing a disease-safe water supply to CNFH so that winter-, spring- and fall-run chinook salmon and steelhead would have access to an additional 41 miles of Battle Creek habitat.	USFWS, USBR, CDFG, NMFS	3406(e)(6)	High
*4. Develop a comprehensive restoration plan for Battle Creek that integrates CNFH operations.	WSRCD, CDFG, USFWS, USBR		High

[10]Although action priority criteria do not directly address endangered species, Action 2 was rated high because restoration of winter-run chinook salmon requires high priority restoration actions, flow enhancement and habitat and water quality improvements.

- Paynes Creek

Action	Involved parties	Tools	Priority
1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve spawning, rearing and migration opportunities for fall-run chinook salmon and steelhead.	Diverters, CDFG, BLM, USFWS, USBR, Tehama County RCD	3406(b)(3)	High
2. Restore and enhance spawning gravel.	CDFG, BLM, USFWS, USBR, Tehama County RCD		High

- Antelope Creek High priority

Action	Involved parties	Tools	Priority
*1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to allow passage of juvenile and adult spring-, fall- and late-fall-run chinook salmon and steelhead.	Diverters, CDFG, USFWS, USBR, USFS	3406(b)(3)	High

Evaluation	Involved parties	Tools	Priority
*1. Evaluate the creation of a more defined stream channel to facilitate fish passage by minimizing water infiltration into the streambed and maintaining flows to the Sacramento River.	Landowners, CDFG, USFWS, USBR	3406(e)(3)	Medium

- Elder Creek

Action	Involved parties	Tools	Priority
1. Work with Tehama County to develop an erosion control ordinance to minimize sediment input into Elder Creek.	Tehama County, CDFG, USFWS, USBR, Tehama County RCD, NRCS		High

Evaluation	Involved parties	Tools	Priority
1. Evaluate the feasibility of constructing a fish passage structure over the Corning Canal Siphon.	CDFG, USFWS, USBR, TCCA	3406(e)(3)	Medium

- Mill Creek High priority

Action	Involved parties	Tools	Priority
*1. Continue to provide instream flows in the valley reach of Mill Creek to facilitate the passage of adult and juvenile spring-, fall- and late-fall-run chinook salmon and steelhead.	Mill Creek Conservancy (MCC), Landowners, CDFG, USFWS, USBR, CDWR	3406(b)(3)	High
*2. Preserve the habitat productivity of Mill Creek through cooperative watershed management and development of a watershed strategy.	CDFG, MCC, USFWS, USBR, Vina RCD		High
*3. Improve spawning habitats in lower Mill Creek for fall-run chinook salmon.	CDFG, MCC, USFWS, USBR, USFWS, Vina RCD		High
*4. Establish, restore, and maintain riparian habitat the riparian habitat along the lower reaches of Mill Creek.	County agencies, California State University at Chico, CDFG, USFWS, USBR, MCC, Los Molinos School District, Vina RCD		High

Evaluation	Involved parties	Tools	Priority
*1. Develop and implement an interim fish passage solution at Clough Dam until such time that a permanent solution is developed and accepted by landowners.	Diverters, MCC, Los Molinos Municipal Water Company, CDFG, CDWR, USFWS, USBR, Vina RCD	3406(e)(3)	Medium

- Thomes Creek

Action	Involved parties	Tools	Priority
1. Modify gravel mining methods to reduce their effects on salmonid spawning habitats.	Gravel miners, Tehama County Planning Commission, CDFG, CDWR, USFWS, USBR		High
2. Employ the most ecologically sound timber extraction practices by implementing the Forest Plan on federal lands within the drainage.	Landowners, USFWS, USBR, USFS, California Department of Forestry and Fire Protection, TCCA		High

Action	Involved parties	Tools	Priority
3. Modify and employ the most ecologically sound grazing practices by implementing the Forest Plan on federal lands and through partnerships on private and state-owned land within the drainage.	Landowners, USFS, USFWS, USBR, Tehama Colusa RCD		High
4. Reduce use of seasonal diversion dams that may be barriers to migrating chinook salmon and steelhead.	Henleyville and Paskenta diversion dam operators, CDFG, USFWS, USBR		Medium

Evaluation	Involved parties	Tools	Priority
1. Identify and evaluate restoring highly erodible watershed areas.	CDFG, USFWS, USBR	3406(e)(6)	High
2. Monitor water quality throughout the creek and identify limiting conditions for salmon.	CDFG, USFWS, USBR		High

- Deer Creek High priority

Action	Involved parties	Tools	Priority
*1. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to supplement instream flows in the lower ten miles of Deer Creek to ensure passage of adult and juvenile spring- and fall-run chinook salmon and steelhead over three diversion dams.	Deer Creek Watershed Conservancy (DCWC), CDFG, USFWS, USBR	3406(b)(3)	High
*2. Develop a watershed management plan to preserve the chinook salmon and steelhead habitat in Deer Creek through cooperative watershed management.	DCWC, CDFG, USFWS, USBR		High
*3. Improve spawning habitats in lower Deer Creek for fall- and late-fall-run chinook salmon.	DCWC, CDFG, USFWS, USBR, Vina RCD		High
*4. Negotiate long-term agreements to restore and preserve riparian habitats along Deer Creek.	Landowners, DCWC, CDFG, USFWS, USBR, Vina RCD		High
*5. Plan and coordinate required flood management activities with least damage to the fishery resources and riparian habitats of lower Deer Creek; and establish, restore, and maintain riparian habitat on Deer Creek.	Tehama County Flood Control, DCWC, COE, CDFG, USFWS, USBR		High

- Stony Creek

Evaluation	Involved parties	Tools	Priority
1. Determine the feasibility of restoring anadromous salmonids by evaluating water releases from Black Butte Dam, water exchanges with the Tehama-Colusa Canal, interim and long-term water diversion solutions at Red Bluff Diversion Dam, water quality improvements, spawning gravel protection and restoration, riparian habitat protection and restoration, creek channel creation, and passage improvements at water diversions.	Stony Creek Task Force, TCCA, CDFG, COE, USFWS, USBR	3406(e)(1), 3406(e)(3), 3406(e)(6)	High

- Big Chico Creek High priority

Action	Involved parties	Tools	Priority
*1. Relocate and screen the M&T Ranch diversion.	M&T Ranch owners, Western Canal Water District (WCWD), USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	High[11]
*2. Repair the Iron Canyon fish ladder.	CDFG, USFWS, USBR, Big Chico Creek Task Force (BCCTF)		Medium
*3. Replenish spawning gravel in reaches modified for flood control.	Chico Parks Department, CDFG, USFWS, USBR, BCCTF		High

[11]Although Action 1 addresses a diversion, it was assigned a high priority because relocating the diversion and associated water rights from Big Chico Creek to the Sacramento River results in an additional 40 cfs in the upper reaches of Butte Creek, providing a significant benefit to spring-run chinook salmon production.

Action	Involved parties	Tools	Priority
*4. Repair the Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five-Mile Diversion.	Chico Parks Department, CDFG, CDWR, COE, USFWS, USBR, BCCTF		Medium
*5. Improve cleaning procedures at One-Mile Pool.	City of Chico, CDFG, USFWS, USBR		High
*6. Protect spring-run chinook salmon summer holding pools by obtaining from willing sellers titles or conservation easements on lands adjacent to the pools.	Landowners, CDFG, USFWS, USBR		High
*7. Cooperate with local landowners to encourage revegetation of denuded stream reaches; and establish, restore, and maintain riparian habitat on Big Chico Creek.	Landowners, Sacramento River Preservation Trust, CDFG, California Department of Parks and Recreation, USFWS, USBR		High
*8. Preserve the productivity of the habitat on Big Chico Creek through cooperative watershed management and development of a watershed management plan.	USFS, CDFG, USFWS, USBR		High

Evaluation	Involved parties	Tools	Priority
1. Evaluate the water management operations between Big Chico Creek and Lindo Channel.	City of Chico, CDFG, CDWR, USFWS, USBR	3406(e)(6)	Medium
2. Evaluate the replenishment of gravel in the flood-diversion reach of Mud Creek.	Butte County, CDFG, CDWR, USFWS, USBR	3406(e)(6)	High

- Butte Creek High priority

Action	Involved parties	Tools	Priority
*1. Obtain additional instream flows from Parrott-Phelan Diversion.	Diverters, Butte Creek Watershed Conservancy (BCWC), CDFG, USFWS, USBR	3406(b)(3)	High
*2. Maintain a minimum 40 cfs instream flow below Centerville Diversion Dam.	BCWC, CDFG, PG&E, USFWS, USBR	3406(b)(3)	High

Action	Involved parties	Tools	Priority
*3. Purchase existing water rights from willing sellers.	Diverters, BCWC, CDFG, USFWS, USBR, SWRCB	3406(b)(3)	High
*4. Build a new high water volume fish ladder at Durham Mutual Dam.	Durham Mutual Water Company (DMWC), BCWC, CDFG, TNC, USFWS, USBR		Medium
*5. Install fish screens on both diversions at Durham Mutual Dam.	Diverters, DMWC, TNC, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
*6. Remove the Western Canal Dam and construct the Western Canal Siphon.	Western Canal Water District (WCWD), BCWC, TNC CDFG, USBR, USFWS	3406(b)(21)	High[12]

[12]Although Action 6 addresses fish passage, it was assigned a high priority because the removal of Western Canal Dam and construction of the Western Canal Siphon returns the stream to natural conditions and enhances anadromous salmonid access to spawning habitats.

Action	Involved parties	Tools	Priority
*7. Remove McPherrin and McGowan dams and provide an alternate source of water as part of the Western Canal Dam removal and siphon construction.	Diverters, WCWD, BCWC, CDFG, USBR, USFWS	3406(b)(3), 3406(b)(21)	High[13]
*8. As available, acquire water rights as a part of the Western Canal Siphon project.	WCWD, BCWC, CDFG, SWRCB, USBR	3406(b)(3)	High
9. Adjudicate water rights and provide water master service for the entire creek.	Diverters, BCWC, CDFG, CDWR, SWRCB, USFWS, USBR		High
*10. Build a new high water volume fish ladder at Adams Dam.	Diverters, BCWC, CDFG, USFWS, USBR		Medium
*11. Install fish screens on both diversions at Adams Dam.	Diverters, BCWC, CDFG, CDWR, NMFS, USFWS, USBR	3406(b)(21)	Medium

[13]Although Action 7 addresses fish passage, it was assigned high priority because removal of McPherrin and McGowan dams returns the stream channel to natural conditions and enhances anadromous salmonid access to spawning habitats.

Action	Involved parties	Tools	Priority
*12. Build a new high water volume fish ladder at Gorrill Dam.	Diverters, CDFG, USFWS, USBR		Medium
*13. Install a fish screen on the Gorrill Dam diversion.	Diverters, BCWC, CDFG, CDWR, NMFS, USFWS, USBR	3406(b)(21)	Medium
*14. Install a fish screen at White Mallard Dam.	Diverters, BCWC, CDFG, CDWR, NMFS, USFWS, USBR	3406(b)(21)	Medium
*15. Eliminate chinook salmon stranding at White Mallard Duck Club outfall.	Diverters, BCWC, CDFG, USFWS, USBR		Medium
16. Rebuild and maintain existing culvert and riser at Drumheller Slough outfall.	Diverters, BCWC, CDFG, USFWS, USBR		Medium
*17. Install screened portable pumps in Butte Creek as an alternative to the Little Dry Creek diversion.	Diverters, BCWC, CDFG, CDWR, NMFS, USFWS, USBR	3406(b)(21)	Medium

Action	Involved parties	Tools	Priority
18. Install a high water volume fish ladder at White Mallard Dam.	Diverters, BCWC, CDFG, USFWS, USBR		Medium
*19. Develop land use plans that create buffer zones between the creek and agricultural, urban, and industrial developments; and restore, maintain, and protect riparian and spring-run chinook salmon summer-holding habitat along Butte Creek.	City and county government agencies, Conservation groups, BCWC, CDFG, USFWS, USBR	3406(e)(6)	High
*20. Install fish screens and fish ladder at Parrott-Phelan Diversion Dam.	Diverters, BCWC, CDFG, USFWS, USBR	3406(b)(21)	Medium
*21. Develop a watershed management program.	BCWC, CDFG, USFWS, USBR		High
22. Establish operational criteria for Sanborn Slough Bifurcation.	Diverters, BCWC, CDFG, USFWS, USBR		Medium
23. Establish operational criteria for the East Barrow pit and West Barrow pit.	Diverters, BCWC, CDFG, USFWS, USBR		Medium

Action	Involved parties	Tools	Priority
24. Establish operational criteria for Nelson Slough.	Diverters, BCWC, CDFG, USFWS, USBR		Medium

Evaluation	Involved parties	Tools	Priority
1. Develop and evaluate operational criteria and potential modifications to Butte Slough outfall.	Diverters, BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
2. Evaluate alternatives or build a new high water volume fish ladder at East-West Diversion Weir.	Diverters, BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
3. Evaluate operational alternatives and establish operational criteria for Sutter Bypass Weir #2.	Diverters, BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
4. Evaluate operational alternatives and establish operational criteria for Sutter Bypass Weir #1.	Diverters, BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium

Evaluation	Involved parties	Tools	Priority
*5. Evaluate alternatives to help fish passage, including the installation of a fish screen, at Sanborn Slough Bifurcation Structure.	Diverters, BCWC, CDFG, CDWR, NMFS, USFWS, USBR	3406(e)(3)	High[14]
6. Evaluate alternatives to help fish passage, including the installation of fish screens, within Sutter Bypass where necessary.	Diverters, BCWC, CDFG, CDWR, NMFS, USFWS, USBR	3406(e)(3)	Medium
7. Evaluate operational alternatives and establish operational criteria for Sutter Bypass Weir #5.	Diverters, BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
8. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #2.	BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
9. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #1.	BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
10. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #5.	BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium
11. Evaluate alternatives to help fish passage, including the installation of a high water volume fish ladder, on Sutter Bypass Weir #3.	BCWC, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	Medium

[14]Although Evaluation 5 addresses fish passage, it was assigned a high priority because passage and screening solutions at the Sanborn Slough Bifurcation Structure can significantly enhance Butte Creek productivity.

Evaluation	Involved parties	Tools	Priority
*12. Evaluate enhancement of fish passage at a natural barrier below the Centerville Diversion Dam.	BCWC, PG&E, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	High[15]
*13. Evaluate fish passage enhancement at PG&E diversion dams and other barriers above Centerville Diversion Dam.	BCWC, Spring-run Chinook Salmon Workgroup, PG&E, CDFG, USFWS, USBR	3406(e)(3), 3406(e)(6)	High[15]
*14. Evaluate the juvenile life history of spring-run chinook salmon.	BCWC, CDFG, USFWS, USBR		Medium
15. Evaluate juvenile and adult chinook salmon stranding in Sutter Bypass and behind Tisdale, Moulton, and Colusa weirs during periods of receding flows on the upper mainstem Sacramento River.	BCWC, CDFG, USFWS, USBR		Medium

[15]Although evaluations 12 and 13 address fish passage, they were assigned high priority because actions resulting from these evaluations could provide access to four miles of deep holding pools and three miles of spawning habitat for spring-run chinook salmon in the vicinity of Centerville and Butte Creek diversion dams (Holtgrieve, D.G. and G.W. Holtgrieve. 1995. Physical stream survey: upper Butte Creek, Butte County, California. The Nature Conservancy and the Spring-run Chinook Salmon Work Group).

- Colusa Basin Drain (westside tributaries)

Action	Involved parties	Tools	Priority
1. Install an adult exclusion device at the Knights Landing outfall for Colusa Basin Drain as an interim action pending completion of Colusa Basin Drain Evaluation 1.	CDFG, USFWS, USBR	3406(e)(1), 3406(e)(6)	Medium

Evaluation	Involved parties	Tools	Priority
1. Investigate the feasibility of restoring the access of anadromous fish to westside tributaries through development of defined migrational routes, sufficient flows, and adequate water temperatures.	CDFG, USFWS, USBR	3406(e)(1), 3406(e)(6)	Medium

- Miscellaneous small tributaries

Evaluation	Involved parties	Tools	Priority
*1. Evaluate the contribution of small Sacramento River tributaries as rearing areas for juvenile winter-, spring-, fall- and late-fall-run chinook salmon and steelhead.	CDFG, USFWS, USBR, Chico State University	3406(e)(6)	High

LOWER SACRAMENTO RIVER AND DELTA TRIBUTARIES

Feather River

Action	Involved parties	Tools	Priority
*1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of fall- and spring-run chinook salmon and steelhead.	CDWR, CDFG, USFWS, USBR	3406(b)(3)	High
2. Improve flows for American shad migration, spawning, incubation and rearing from April to June, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	Diverters, CDWR, CDFG, USFWS, USBR	3406(b)(3)	High
*3. Develop and utilize a temperature model as a tool for river management.	CDWR		High

Evaluation	Involved parties	Tools	Priority
*1. Evaluate the response of spawning salmonids to increased flows in the low-flow channel.	CDWR, CDFG		High
*2. Evaluate the quality of spawning gravel in areas used by chinook salmon, and if indicated, consider gravel renovation or supplementation to enhance substrate quality.	CDWR		High
*3. Evaluate the distribution of Feather River Fish Hatchery chinook salmon in Central Valley stocks and determine the genetic integrity of Feather River spring-run chinook salmon.	CDWR, CDFG		Low
4. Identify and attempt to maintain adequate flows and temperatures for white sturgeon and green sturgeon migration, spawning, incubation and rearing from February to May, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	CDFG, CDWR		High
5. Identify and remove physical and water quality barriers that impede access for white sturgeon and green sturgeon to spawning habitat or facilitate passage around these barriers.	CDFG, CDWR		Medium
6. Identify the extent of white sturgeon and green sturgeon entrainment at diversions and pumps and reduce or eliminate entrainment if found to be substantial.	CDFG, CDWR		Medium
7. Identify white sturgeon and green sturgeon spawning sites and evaluate the availability and use by adult sturgeon of spawning habitat.	CDFG, CDWR		High
8. Determine the effects of poaching and fishing on the number of spawning white sturgeon and green sturgeon.	CDFG		Low

Evaluation	Involved parties	Tools	Priority
9. Identify and implement actions that maintain mean daily water temperatures between 61ºF and 65ºF for at least one month from April 1 to June 30 for American shad spawning, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	CDFG, CDWR		High

Yuba River

Action	Involved parties	Tools	Priority
*1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of chinook salmon and steelhead.	Yuba County Water Agency (YCWA), SWRCB, CDFG, USFWS, USBR	3406(b)(3)	High
2. Improve flows for American shad migration, spawning, incubation and rearing from April to June, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	YCWA, SWRCB, CDFG, USFWS, USBR	3406(b)(3)	High
3. Reduce and control flow fluctuations to avoid and minimize adverse effects to juvenile salmonids.	YCWA, PG&E, SWRCB, CDFG		High

Action	Involved parties	Tools	Priority
4. Maintain adequate instream flows for temperature control.	YCWA, CDFG, USFWS, USBR	3406(b)(3)	High
*5. Improve efficiency of screening devices at Hallwood-Cordua and Brophy-South Yuba water diversions, and construct screens at the Brown's Valley water diversion and other unscreened diversions.	Diverters, SWRCB, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
6. Construct or improve the fish bypasses at Hallwood-Cordua and Brophy-South Yuba water diversion.	Diverters, SWRCB, USFWS, USBR, NMFS, CDFG, CDWR		Medium
*7. Facilitate passage of spawning adult salmonids by maintaining appropriate flows through the fish ladders, or by modifying the fish ladders at Daguerre Point Dam.	YCWA, CDFG, COE, USFWS, USBR	3406(b)(3)	Medium
8. Purchase streambank conservation easements to improve salmonid habitat and instream cover.	Landowners, YCWA, BLM, USFWS, USBR		High
9. Facilitate passage of juvenile salmonids by modifying the dam face of Daguerre Point Dam.	YCWA, CDFG, COE		Medium

Action	Involved parties	Tools	Priority
10. Operate reservoirs to provide adequate water temperatures for anadromous fish.	Yuba River Water Temperature Advisory Committee, SWRCB		High

Evaluation	Involved parties	Tools	Priority
1. Evaluate the effectiveness of pulse flows to facilitate successful juvenile salmonid emigration.	YCWA, CDFG, USFWS, USBR	3406(e)(6)	High
2. Evaluate whether enhancement of water temperature control via shutter configuration and present management of the cold water pool at New Bullards Bar Dam is effective, and modify the water release outlets at Englebright Dam if enhancement of water temperature control via shutter configuration is effective.	YCWA, CDFG, PG&E, USFWS, USBR	3406(e)(6)	High
3. Identify and attempt to implement actions that will maintain mean daily water temperatures between 61EF and 65EF for at least one month from April 1 to June 30 for American shad, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	YCWA, CDFG, USFWS, USBR	3406(g)	High
*4. Evaluate the benefits of restoring stream channel and riparian habitats of the Yuba River, including the creation of side channels for spawning and rearing habitats for salmonids.	YCWA, PG&E, CDFG, USFWS	3406(e)(6)	High

Bear River

Action	Involved parties	Tools	Priority
1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of chinook salmon and steelhead.	South Sutter Water District (SSWD), SWRCB, CDFG, USFWS, USBR	3406(b)(3)	High
2. Provide adequate water temperatures for all life-stages of chinook salmon and steelhead.	SSWD, SWRCB, CDFG		High
3. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
*4. Negotiate removal or modification of the culvert crossing at Patterson Sand and Gravel and other physical and chemical barriers impeding anadromous fish migration.	Patterson Sand and Gravel, CDFG, USFWS, USBR		Medium

Evaluation	Involved parties	Tools	Priority
1. Determine and evaluate instream flow requirements that ensure adequate flows for all life stages of all salmonids.	SSWD, CDFG, USFWS, USBR		High

Evaluation	Involved parties	Tools	Priority
2. Evaluate the extent that white sturgeon and green sturgeon use the Bear River for spawning and rearing.	CDFG, USFWS		High
3. Monitor water quality, particularly at agricultural return outfalls, and evaluate potential effects on anadromous fish.	Diverters, CDFG		High
4. Evaluate the extent that poaching or fishing reduces the numbers of adult sturgeon.	CDFG, USFWS		Low

American River High priority

<table>
<tr><th>Action</th><th>Involved parties</th><th>Tools</th><th>Priority</th></tr>
<tr><td>*1. Develop and implement a river regulation plan that meets the following flow objectives by modifying CVP operations, using (b)(2) water, and acquiring water from willing sellers as needed.

<table>
<tr><th rowspan="2">Month</th><th colspan="4">American River minimum flow objectives[a] (cfs)</th></tr>
<tr><th>Wet[b]</th><th>Above and below normal</th><th>Dry and critical</th><th>Critical relaxation</th></tr>
<tr><td>October</td><td>2,500</td><td>2,000</td><td>1,750</td><td>800</td></tr>
<tr><td>November-February</td><td>2,500</td><td>2,000</td><td>1,750</td><td>1,200</td></tr>
<tr><td>March-May</td><td>4,500</td><td>3,000</td><td>2,000</td><td>1,500</td></tr>
<tr><td>June</td><td>4,500</td><td>3,000</td><td>2,000</td><td>500</td></tr>
<tr><td>July</td><td>2,500</td><td>2,500</td><td>1,500</td><td>500</td></tr>
<tr><td>August</td><td>2,500</td><td>2,000</td><td>1,000</td><td>500</td></tr>
<tr><td>September</td><td>2,500</td><td>1,500</td><td>500</td><td>500</td></tr>
</table>
[a] A multi-agency and interested party management team should be formed to review and adjust flows in consideration of carryover storage and hydrologic conditions as needed to provide for the long-term needs of anadromous fish. Flow objectives should be met for the entire reach of the American River downstream of Nimbus Dam.
[b] Year types should be based on an American River index, or on consideration of carryover storage and hydrologic conditions in the American River watershed.</td><td>Sacramento Area Water Forum (SAWF), CDFG, USBR, USFWS</td><td>3406(b)(1)(B), 3406(b)(2), 3406(b)(3)</td><td>High</td></tr>
<tr><td>*2. Develop a long-term water allocation plan for the American River watershed.</td><td>SAWF, CDFG, Other water users, USFWS, USBR</td><td>3406(b)(1)(B), 3406(b)(2), 3406(b)(3)</td><td>High</td></tr>
</table>

Action	Involved parties	Tools	Priority
*3. Reduce and control flow fluctuations to avoid and minimize adverse effects on juvenile salmonids.	USFWS, USBR, CDFG	3406(b)(9)	High
*4. Reconfigure Folsom Dam shutters for improved management of Folsom Reservoir's cold water pool and better control over the temperature of water released downstream.	County of Sacramento, Sacramento Area Flood Control Association (SAFCA), USFWS, USBR, CDFG	3406(b)(1)(B)	High
5. Replenish spawning gravel and restore existing spawning grounds.	USFWS, USBR, CDFG	3406(b)(13)	High
6. Improve the fish screen at Fairbairn Water Treatment Plant.	City of Sacramento, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
7. Modify the timing and rate of water diverted from the river annually to reduce entrainment losses of juvenile salmonids.	City of Sacramento, Other water users, CDFG, USFWS, USBR	3406(b)(1)(B)	Medium

Action	Involved parties	Tools	Priority
8. Develop a riparian corridor management plan to improve and protect riparian habitat and instream cover.	SAFCA, COE, USFWS, USBR, CDFG	3406(b)(13)	High
9. Terminate current programs that remove woody debris from the river channel.	County of Sacramento, City of Sacramento, SAFCA, COE, USFWS, USBR, CDFG		High
*10. Increase flows for American shad migration, spawning, incubation and rearing from April to June, by modifying CVP operations, by using dedicated water, and by acquiring water from willing sellers, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	SAWF, USFWS, USBR, CDFG	3406(b)(1)(B), 3406(b)(2), 3406(b)(3)	High

Evaluation	Involved parties	Tools	Priority
1. Evaluate the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids.	USFWS, USBR, CDFG		High
2. Evaluate and refine a river regulation plan that provides flows to protect all life stages of anadromous fish based on water storage at Folsom Reservoir and predicted hydrologic conditions in the American River watershed.	SAWF, CDFG, USFWS, USBR	3406(g)	High

Evaluation	Involved parties	Tools	Priority
3. Identify and implement actions that maintain mean daily water temperatures between 61ºF and 65ºF for at least one month from April 1 to June 30 for American shad spawning, consistent with action to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	CDFG, CDWR		High

Mokelumne River

Action	Involved parties	Tools	Priority
1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of chinook salmon and steelhead.	East Bay Municipal Utility District (EBMUD), SWRCB, Woodbridge Irrigation District (WID), FERC, CDFG, USFWS	3406(b)(3)	High
*2. Replenish gravel suitable for salmonid spawning habitat.	CDFG, EBMUD		High
*3. Cleanse spawning gravel of fine sediments and prevent sedimentation of spawning gravel.	CDFG, EBMUD		High
4. Reduce and control flow fluctuations to avoid and minimize adverse effects to juvenile salmonids.	CDFG, EBMUD		High
5. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, CDFG, CDWR, USFWS, USBR, NMFS	3406(b)(21)	Medium
6. Maintain suitable water temperatures for all salmonid life stages.	EBMUD, CDFG		High

Action	Involved parties	Tools	Priority
7. Enhance and maintain the riparian corridor to improve streambank and channel rearing habitat for juvenile salmonids.	Landowners, CDFG		High
8. Establish and enforce water quality standards to provide optimal water quality for all life history stages of salmonids.	CDFG		High
9. Eliminate or restrict gravel mining operations in the Mokelumne River flood plain to prevent damage to potential spawning areas and encroachment of vegetation.	Gravel miners, CDFG		High

Evaluation	Involved parties	Tools	Priority
1. Evaluate the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids in the spring, and determine the efficacy in all water year types.	EBMUD, CDFG, USFWS, USBR	3406(e)(6)	High
2. Evaluate and facilitate passage of spawning adult salmonids in the fall and juvenile salmonids in the spring past Woodbridge Irrigation District Diversion Dam and Lodi Lake.	WID, City of Lodi, EBMUD, CDFG, USFWS	3406(e)(3)	Medium
3. Evaluate the incidence of predation on juvenile salmonids emigrating past Woodbridge Dam, and investigate potential remedial actions if necessary.	WID, EBMUD, CDFG, USFWS, USBR	3406(e)(6)	Medium
4. Evaluate the effects of extending the closure of the fishing season from 31 December to 31 March (and possibly to 1 June) to protect juvenile salmonids and adult steelhead and prevent anglers from wading on redds.	CDFG		Low

Cosumnes River

Action	Involved parties	Tools	Priority
1. Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to reduce water diversions or augment instream flows during critical periods for salmonids.	Diverters, CDFG, USFWS, USBR	3406(b)(3)	High
2. Pursue opportunities to purchase existing water rights from willing sellers consistent with applicable guidelines to ensure adequate flows for all life stages of salmonids.	CDFG, The Nature Conservancy (TNC), USFWS, USBR	3406(b)(3)	High
*3. Enforce Fish and Game Codes that prohibit construction of unlicensed dams.	CDFG		Medium
4. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, CDFG, CDWR, USFWS, USBR, NMFS, TNC	3406(b)(21)	Medium
5. Establish a riparian corridor protection zone.	TNC, Landowners, CDFG		High
6. Rehabilitate damaged areas and remedy incompatible land practices to reduce sedimentation and instream water temperatures.	TNC, Landowners, CDFG		High

Evaluation	Involved parties	Tools	Priority
1. Determine and evaluate instream flow requirements that ensure adequate flows for all life stages of all salmonids.	Diverters, TNC, CDFG, USFWS, USBR	3406(e)(6)	High
2. Evaluate and facilitate passage of adult and juvenile salmonids at existing diversion dams and barriers.	Diverters and dam builders, TNC, CDFG, USBR, USFWS	3406(e)(3)	Medium
3. Evaluate the feasibility of restoring and increasing available spawning and rearing habitat for salmonids.	TNC, CDFG, USBR, USFWS	3406(e)(6)	High

Calaveras River

Action	Involved parties	Tools	Priority
1. Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life history stages of chinook salmon.	Calaveras County Water District, Stockton East Water District (SEWD), CDFG, COE, USFWS, USBR	3406(b)(3)	High
2. Provide flows of suitable water temperatures for all salmonid life stages.	CDFG, USFWS, USBR	3406(b)(3)	High
3. Facilitate passage of adult and juvenile salmonids at existing diversion dams and barriers.	Diverters, CDFG		Medium
4. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, CDFG, CDWR, USFWS, NMFS, USBR	3406(b)(21)	Medium

Evaluation	Involved parties	Tools	Priority
1. Monitor sport fishing and evaluate the need for regulations to protect salmonids.	CDFG		Low

Evaluation	Involved parties	Tools	Priority
2. Evaluate instream flow, water temperature and fish habitat use in the Calaveras River to develop a real-time management program so that reservoir operations can maintain suitable habitat when fish are present.	CDFG, Diverters, USFWS		High

SAN JOAQUIN BASIN

Merced River High priority

Action	Involved parties	Tools	Priority
*1. Supplement flows provided pursuant to the Davis-Grunsky Contract Number D-GGR17 and FERC License Number 2179 with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life history stages of chinook salmon.	Merced Irrigation District (MID), Diverters, CDFG, CDWR, USFWS, USBR	3406(b)(3)	High
2. Reduce adverse effects of rapid flow fluctuations.	MID, CDFG, USFWS, USBR		High
3. Improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel.	Landowners, Merced County, NRCS, CDFG, USFWS, USBR		High

Action	Involved parties	Tools	Priority
4. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
5. Establish a streamwatch program to increase public participation in river management.	Public, CDFG, USFWS		Low

Evaluation	Involved parties	Tools	Priority
1. Identify and implement actions to provide suitable water temperatures for all life stages of chinook salmon; establish maximum temperature objectives of 56EF from October 15 to February 15 for incubation and 65EF from April 1 to May 31 for juvenile emigration.	Dam operators, CDFG, USFWS, USBR	3406(g)	High
*2. Evaluate and implement actions to reduce predation on juvenile chinook salmon, including actions to isolate “ponded” sections of the river.	CDFG, USFWS, USBR	3406(e)(6)	Medium
3. Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead.	Dam operators, CDFG, USFWS, USBR		High

Tuolumne River High priority

Action	Involved parties	Tools	Priority
*1. Implement a flow schedule as specified in the terms of the FERC order resulting from the New Don Pedro Project (FERC Proceeding P-2299-024). Supplement FERC agreement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life history stages of chinook salmon.	City and County of San Francisco, Turlock Irrigation District (TID), Modesto Irrigation District (MID), Lower Tuolumne River Technical Advisory Committee (LTTAC), FERC, USFWS, USBR	3406(b)(3)	High
*2. Improve watershed management and restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel and performing an integrated evaluation of biological and geomorphic processes.	Landowners, NRCS, CDFG, USFWS, USBR, LTTAC		High
3. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, LTTAC, CDFG, CDWR, NMFS, USFWS, USBR	3406(b)(21)	Medium

Action	Involved parties	Tools	Priority
4. Support the Tuolumne River Interpretive Center.	CDFG, LTTAC		Low
5. Establish a "streamwatch" program to increase public participation in river management.	Public, LTTAC, CDFG, USFWS		Low
6. Coordinate the AFRP with appropriate activities supported by the Riparian and Recreation Improvement fund that was established by the New Don Pedro Settlement Agreement.	LLTAC, USFWS, USBR		Low

Evaluation	Involved parties	Tools	Priority
1. Identify and implement actions to provide suitable water temperatures for all life stages of chinook salmon; establish maximum temperature objectives of 56EF from October 15 to February 15 for incubation and 65EF from April 1 to May 31 for juvenile emigration.	Dam operators, CDFG, USFWS, USBR, LTTAC	3406(g)	High
*2. Evaluate and implement actions to reduce predation on juvenile chinook salmon, including actions to isolate "ponded" sections of the river.	TID, MID, LTTAC, CDFG, USFWS, USBR	3406(e)(6)	Medium
3. Evaluate the effects of flow fluctuations established by the guidelines of the FERC Settlement Agreement on spawning, incubation, and rearing of chinook salmon, and if substantial adverse effects are indicated, modify guidelines to reduce effects.	Diverters, Hydropower operators, LTTAC, CDFG, USFWS, USBR		High

Evaluation	Involved parties	Tools	Priority
4. Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead.	Diverters, Hydropower operators, LTTAC, CDFG, USFWS, USBR		High

Stanislaus River High priority

<table>
<tr><th>Action</th><th>Involved parties</th><th>Tools</th><th>Priority</th></tr>
<tr><td>*1. Implement an interim river regulation plan that meets the following flow schedule by supplementing the 1987 agreement between USBR and CDFG[a], through reoperation of New Melones Dam, use of (b)(2) water, and acquisition of water from willing sellers as needed.
<table>
<tr><th rowspan="2">Month</th><th colspan="5">Stanislaus River flow schedules (cfs) by year type[b]</th></tr>
<tr><th>Wet</th><th>Above normal</th><th>Below normal</th><th>Dry</th><th>Critical</th></tr>
<tr><td>October</td><td>350</td><td>350</td><td>250</td><td>250</td><td>200</td></tr>
<tr><td>November-March</td><td>400</td><td>350</td><td>300</td><td>275</td><td>250</td></tr>
<tr><td>April</td><td>1,500</td><td>1,500</td><td>300/1500[c]</td><td>300/1500[d]</td><td>300/1500[e]</td></tr>
<tr><td>May</td><td>1,500</td><td>1,500</td><td>1500/300[c]</td><td>1500/300[d]</td><td>1500/300[e]</td></tr>
<tr><td>June</td><td>1500</td><td>800</td><td>250</td><td>200</td><td>200</td></tr>
<tr><td>July-September</td><td>300</td><td>300</td><td>250</td><td>200</td><td>200</td></tr>
<tr><td>Total (taf)</td><td>468</td><td>410</td><td>313</td><td>257</td><td>247</td></tr>
<tr><td>Baseline (taf)</td><td>1,015</td><td>722</td><td>406</td><td>242</td><td>269</td></tr>
<tr><td>Unimpaired (taf)</td><td>1,772</td><td>1,291</td><td>920</td><td>631</td><td>449</td></tr>
</table>
[a] Existing flow requirements are 98 to 302 taf, based on the 1987 agreement between CDFG and USBR (CDFG and USBR 1987); actual schedule is determined on an annual basis and depends on available yield, carryover storage, and hydrologic conditions.
[b] Year type based on San Joaquin basin 60-20-20 index. Flow schedules are releases from Goodwin Dam.
[c] In a below normal water year, April-May flow would be maintained for 45 days at 1500 cfs and 16 days at 300 cfs.
[d] In a dry water year, April-May flow would be maintained for 30 days at 1500 cfs and 31 days at 300 cfs.
[e] In a critical water year, April-May flow would be maintained at 1500 cfs for 30 days and at 300 cfs for 31 days.</td><td>CDFG, USFWS, USBR, Oakdale Irrigation District, South San Joaquin Irrigation District, Stockton East Water District, Central San Joaquin Water Conservation District, South Delta Water Agency (SDWA), COE</td><td>3406(b)(1)(B), 3046(b)(2), 3406(b)(3)</td><td>High</td></tr>
</table>

Action	Involved parties	Tools	Priority
*2. Improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel.	Landowners, CDFG, NRCS, COE, USFWS, USBR	3406(b)(13)	High
3. Screen all diversions to protect all life history stages of anadromous fish.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium

Evaluation	Involved parties	Tools	Priority
*1. Identify and implement actions to provide suitable water temperatures for all life stages of chinook salmon, consistent with efforts to maintain adequate flows to provide fish habitat. Establish maximum temperature objectives of 56EF from October 15 to February 15 for incubation and 65EF from April 1 to May 31 for juvenile rearing and emigration.	Dam operators, CDFG, USFWS, USBR, COE	3406(g)	High
*2. Evaluate and implement actions to reduce predation on juvenile chinook salmon, including actions to isolate “ponded” sections of the river.	CDFG, USFWS, USBR, COE	3406(e)(6)	Medium
*3. Evaluate and refine a river regulation plan that provides adequate flows to protect all life stages of anadromous fish based on water storage at New Melones Reservoir, predicted hydrologic conditions, and current aquatic habitat conditions.	USFWS, USBR, CDFG, COE		High

Evaluation	Involved parties	Tools	Priority
4. Develop a carryover storage target for New Melones Reservoir to ensure Vernalis flow standards are met during the 30-day pulse flow period during the third year of a dry or critical period. This will protect at least one of three year classes of chinook salmon during emigration.	USFWS, USBR, CDFG, SEWD	3406(g)	High
5. Evaluate use of the Stanislaus River by American shad and consider increasing flows and maintaining mean daily water temperatures between 61EF and 65EF from April to June when hydrologic conditions are adequate to minimize adverse effects to water supply operations and in a manner consistent with actions to protect chinook salmon.	Dam operators, CDFG, USFWS, USBR	3406(g)	High
6. Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead.	USFWS, USBR, CDFG, COE, SEWD		

Mainstem San Joaquin River High priority

Action	Involved parties	Tools	Priority
*1. Coordinate with CDFG and others and acquire water from willing sellers consistent with applicable guidelines as needed to implement a flow schedule that improves conditions for all life stages of San Joaquin chinook salmon migrating through, or rearing in, the lower San Joaquin River.	River and tributary water managers and diverters, CDFG, SWRCB, USFWS, USBR	3406(b)(1)(B), 3406(b)(2), 3406(b)(3)	High
2. Develop an equitable, integrated San Joaquin Basin plan that will meet outflow:export objectives identified under Sacramento-San Joaquin Delta Operational Target 4 and Supplemental Actions Requiring Water 7, 8, and 9.	River and tributary water managers and diverters, CDFG, SWRCB, CDWR, USFWS, USBR		High
*3. Reduce or eliminate entrainment of juvenile chinook salmon at Banta-Carbona, West Stanislaus, Patterson, and El Soyo diversions by implementing the Anadromous Fish Screen Program in conjunction with other programs.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium
4. Reduce or eliminate entrainment of juvenile chinook salmon at smaller riparian pumps and diversions on the mainstem San Joaquin River.	Diverters, USFWS, USBR, NMFS, CDFG, CDWR	3406(b)(21)	Medium

Action	Involved parties	Tools	Priority
5. Maintain the 6 mg/L dissolved oxygen standard during September through November in the San Joaquin River between Turner Cut and Stockton, as described in the SWRCB's 1995 Water Quality Control Plan.	CDFG, CDWR, COE, City of Stockton, Port of Stockton		High
6. Establish a basin-wide conjunctive water use program.	River and tributary water managers and diverters, CDFG, CDWR, USBR, USFWS		High

Evaluation	Involved parties	Tools	Priority
1. Identify and implement actions to improve watershed management to restore and protect instream and riparian habitat.	Landowners, CDFG		High
2. Identify and implement actions to maintain suitable water temperatures or minimize length of exposure to unsuitable water temperatures for all life stages of chinook salmon in the San Joaquin River and Delta.	River and tributary water managers and diverters, CDFG, USFWS, USBR	3406(g)	High
3. Identify and implement actions to reduce predation on juvenile chinook salmon.	CDFG, USFWS		Medium

Evaluation	Involved parties	Tools	Priority
4. Identify and attempt to maintain adequate flows for migration, spawning, incubation and rearing of white sturgeon and green sturgeon from February to May, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	River and tributary water managers and diverters, CDFG, CDWR		High
5. Identify and attempt to implement actions that will maintain mean daily water temperatures between 61EF and 65EF for at least one month from April 1 to June 30 for American shad, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations.	CDFG, USFWS, USBR	3406(g)	High
6. Evaluate the potential to develop and implement a strategy of coordinating a variety of specific actions, such as coincident pulse flows on San Joaquin tributaries, reduced Delta exports, hatchery releases, and gravel cleaning to stimulate outmigration and reduce predation and entrainment.	River and tributary water managers and diverters, CDFG, USFWS, USBR		High
7. Identify, evaluate the need for, and, if needed, attempt to maintain adequate flows for migration of steelhead, consistent with efforts to maintain adequate flows for chinook salmon.	River and tributary water managers and diverters, CDFG, USFWS, USBR	3406(b)(3)	High

SACRAMENTO-SAN JOAQUIN DELTA Highest priority

Improvements to aquatic habitat in the Delta are essential to restore the natural production of anadromous fish in the Central Valley because habitat in the Delta is highly degraded and all species and races of fish use the Delta at some stage in their life history.

Recent actions to improve fish habitat in the Delta are described in the 15 December 1994, Principles for Agreement on Bay-Delta Standards between the State of California and the Federal Government (Bay-Delta Agreement) and in the State Water Resources Control Board's May, 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 WQCP). The AFRP assumes that those actions will continue to be implemented in the future. Should changes occur in the 1995 WQCP objectives or the Bay-Delta Agreement, the AFRP will need to determine if new restoration actions in the Delta beyond those described below are needed in light of those changes.

Both the Bay-Delta Agreement and 1995 WQCP require operational flexibility of state and federal water projects to provide protection for anadromous fish. As described in the Bay-Delta Agreement, initial deliberation and operational decisions to achieve this flexibility will be made by the California Water Policy Council and Federal Ecosystem Directorate (CALFED) Coordination Group (Ops Group) in consultation with water users, environmentalists and fishery representatives. The Ops Group develops ways to use the operational flexibility of the State Water Project (SWP) and Central Valley Project (CVP) such that species using the estuary receive more protection than they would have received by strict adherence to 1995 WQCP standards.

Operational flexibility allows the Ops Group to meet operational targets that contribute to doubling natural production of anadromous fish, and the Bay-Delta Agreement's criterion to maintain water quality conditions which, together with other measures in the watershed, would be sufficient to achieve a doubling of production of chinook salmon. The operational targets listed in the first table below are the AFRP recommendations to the Ops Group. These targets allow variability in the timing and nature of operations to meet requirements in the 1995 WQCP.

A second table lists supplemental actions requiring water that may involve changes in operations beyond the authority of the Ops Group that further contribute to meeting the AFRP goal. In this table, some supplemental actions are identical to operational targets because their full implementation may be beyond the authority of the Ops Group. Supplemental actions can be met through a combination of project reoperation (Section 3406(b)(1)), management of 800,000 acre-feet of CVP yield (Section 3406(b)(2)), and acquisition of water

from willing sellers (Section 3406(b)(3)). The best combination of these three tools for achieving the actions will be determined through the preparation of annual implementation plans along with guidance from the long-term water management plan, which will seek to maximize the biological benefits of the actions while minimizing their water supply impacts. In some years, the three tools may not be sufficient to fully implement all actions, resulting in partial implementation of some actions. Sub-priorities are provided as guidance for partial implementation for some actions.

These supplemental actions (some in slightly modified form) are being used to develop an implementation plan in the form of the CVP operational forecast for water year 1997 and to develop a long-term CVP Water Management Plan that integrates these supplemental actions with upstream flow actions and Delta operational targets.

In addition, these supplemental actions requiring water formed the basis for the nine priorities that were provided to the PEIS team for their use in developing alternatives for the PEIS in a letter to interested parties dated October 25, 1996 announcing an AFRP workshop on proposed fish flow and habitat objectives for selected Central Valley rivers and the Delta.

Supplemental actions not requiring water include screens at diversions and a channel barrier. Some of these actions are not under the direct authority of the Ops Group or addressed by the 1995 WQCP, however, some actions may be addressed by Category III of the Bay-Delta Agreement.

In developing this Restoration Plan, Interior has made an initial programmatic-level determination of the reasonableness of the restoration actions included in the following tables. As USFWS and USBR move towards specific plans for implementation based on this Restoration Plan, they will continue to examine the reasonableness of a particular mix of restoration actions. The final decision to implement any action will be done through the implementation process and described in the implementation plans.

The following operational targets, supplemental actions, and evaluations are intended to be consistent with and supportive of the CALFED Bay-Delta process, the Bay-Delta Agreement's criterion to maintain conditions sufficient to achieve a doubling of production of chinook salmon, and with the narrative water quality objective in the 1995 WQCP to maintain water quality conditions and other measures "sufficient to achieve a doubling of natural production of chinook salmon from the average production of 1967-1991, consistent with the provisions of State and federal law."

Operational target	Involved parties	Tools	Priority
*1. Close Delta Cross Channel (DCC) up to 45 days in the November through January period, when juvenile salmon enter the Delta or flow or turbidity changes trigger salmon migration. The DCC gates are to be closed within 24 hours when any of the following triggers occur: 1) daily average flow or turbidity of the Sacramento River at Freeport increases by 20% from the previous 3 day running average; 2) capture of at least one juvenile chinook salmon of spring-run size in the Sacramento River tributaries and in the Sutter Bypass, or in the Sacramento River at or below Knights Landing; 3) capture of at least two juvenile chinook salmon of any race in the Sacramento River at or below Knights Landing at any Interagency Ecological Program (IEP) sampling station in one day. The gate closure period will be for 10, 15 and 20 consecutive days in November, December and January, respectively, and will remain closed for another 10 consecutive days if any of the above triggers are met after the initial closure for that month.	CALFED agencies	WQCP, Bay-Delta Agreement, 3406(b)(1)(B)	High[1]

[1]Although Operational target 1 addresses fish passage, it was assigned high priority because potential to increase fish production is great.

Operational target	Involved parties	Tools	Priority
*2. When the DCC is closed during the November through January period, limit the average SWP and CVP exports to no greater than 35% of Delta inflow if Evaluation 3 determines that a relatively high ratio of Delta export to inflow limits juvenile salmon survival through the Sacramento River Delta. Sub-priorities: 1) January, 2) December, 3) November.	CALFED agencies	WQCP, Bay-Delta Agreement, 3406(b)(1)(B)	High
*3. Maximize DCC closure from May 21 through June 15 when chinook salmon and other anadromous species are abundant in the lower Sacramento River, but keep open when the net benefit to striped bass and other sensitive species in the lower San Joaquin River is great**.**	CALFED agencies, United States Coast Guard, Boating interests	WQCP, Bay-Delta Agreement, 3406(b)(1)(B)	High[2]
*4. Maintain an average export to inflow ratio of no more than 45% during February in dry years by increasing the ratio to ~55% in early February and decreasing the ratio to ~35% in late February, when winter-run chinook salmon smolts are present.	CALFED agencies	WQCP, Bay-Delta Agreement, 3406(b)(1)(B)	High
*5. Minimize fish losses and predation at facilities by operating state and federal pumps interchangeably when this operation achieves a net benefit to anadromous fish production.	CALFED agencies	WQCP, Bay-Delta Agreement, 3406(b)(1)(B)	Medium

[2]Although Operational target 3 addresses fish passage, it was assigned high priority because potential to increase fish production is great.

<table>
<tr><th>Supplemental action requiring water</th><th>Involved parties</th><th>Tools</th><th>Priority</th></tr>
<tr><td>*6. In conjunction with operation of a barrier at the head of Old River and consistent with efforts to conduct evaluations 1 and 2, maximize the difference between flows and export rates at levels greater than those required under the Delta smelt biological opinion during the 30-day April and May pulse flow period.</td><td>CALFED agencies</td><td>3406(b)(2), 3406(b)(3)</td><td>High</td></tr>
<tr><td>*7. When a barrier at the head of Old River is not operational, limit the combined SWP and CVP exports to 1,500 cfs or maintain a Vernalis inflow to total export ratio of 5 to 1 during the 30-day April through May pulse flow period.</td><td>CALFED agencies</td><td>3406(b)(2), 3406(b)(3)</td><td>High</td></tr>
<tr><td>*8. Increase the level of protection targeted by the May and June X2 requirements to a 1962 level of development (LOD), as described below, where the number of days when X2 is required at Chipps Island in Table A of the 1995 WQCP is shown to the right of the requirements to meet a 1962 LOD and where PMI is the previous months eight river index in acre feet.
<table>
<tr><th></th><th colspan="2">1962 LOD</th><th colspan="2">IN WQCP</th></tr>
<tr><th>PMI</th><th>MAY</th><th>JUNE</th><th>MAY</th><th>JUNE</th></tr>
<tr><td>#1500</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1750</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>2000</td><td>4</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>2250</td><td>13</td><td>1</td><td>3</td><td>0</td></tr>
<tr><td>2500</td><td>24</td><td>3</td><td>11</td><td>1</td></tr>
<tr><td>2750</td><td>29</td><td>7</td><td>20</td><td>2</td></tr>
<tr><td>3000</td><td>30</td><td>12</td><td>27</td><td>4</td></tr>
<tr><td>3250</td><td>31</td><td>18</td><td>29</td><td>8</td></tr>
<tr><td>3500</td><td>31</td><td>23</td><td>30</td><td>13</td></tr>
<tr><td>3750</td><td>31</td><td>26</td><td>31</td><td>18</td></tr>
<tr><td>4000</td><td>31</td><td>28</td><td>31</td><td>23</td></tr>
<tr><td>4250</td><td>31</td><td>29</td><td>31</td><td>25</td></tr>
<tr><td>4500</td><td>31</td><td>29</td><td>31</td><td>27</td></tr>
<tr><td>4750</td><td>31</td><td>30</td><td>31</td><td>28</td></tr>
</table>
</td><td>CALFED agencies</td><td>3406(b)(2),</td><td>High</td></tr>
</table>

Supplemental action requiring water	Involved parties	Tools	Priority
*9. During May, maintain at least 13,000 cfs daily flow in the Sacramento River at the I Street Bridge and 9,000 cfs at Knights Landing to improve transport of eggs and larval striped bass and other young anadromous fish and to reduce egg settling and mortality at low flows. Sub-priorities: 1) 13,000 cfs at I Street Bridge, 2) 9,000 cfs at Knights Landing.	CALFED agencies	3406(b)(2), 3406(b)(3)	High
*10. During the last half of May, ramp (linearly) the total SWP and CVP export level from what it is at the end of the 30-day April and May pulse flow period to that export level proposed by the SWP and CVP to meet the requirements of the 1995 WQCP on June 1.	CALFED agencies	3406(b)(2), 3406(b)(3)	High
*11. Close the DCC during the November through January period beyond the 45-day limit defined under Operational Target 1 should meeting one of the triggers stipulated in Operational Target 1 require additional closure.	CALFED agencies	3406(b)(2), 3406(b)(3),	High[1]
*12. Limit the average SWP and CVP exports to no greater than 35% of Delta inflow in July. Sub-priorities: 1) July 1 to July 14, 2) July 16 to July 31.	CALFED agencies	3406(b)(2), 3406(b)(3)	High
13. Supplement Delta outflow for migration and rearing of white sturgeon, green sturgeon, striped bass, and American shad by modifying CVP operations and using water available under the CVPIA (sections 3406(b)(2) and (3)), consistent with actions to protect chinook salmon and steelhead.	CALFED agencies	3406(b)(2), 3406(b)(3)	High

[1]Although Supplemental action 11 addresses fish passage, it was assigned high priority because potential to increase fish production is great.

Supplemental action requiring water	Involved parties	Tools	Priority
*14. When the DCC is closed during the November through January period, limit the average SWP and CVP exports to no greater than 35% of Delta inflow if Evaluation 3 determines that a relatively high ratio of export to inflow limits survival of juvenile chinook salmon migrating through the Sacramento River Delta. Sub-priorities: 1) January, 2) December, 3) November.	CALFED agencies	3406(b)(2), 3406(b)(3)	High

Supplemental action not requiring water	Involved parties	Tools	Priority
*15. Implement actions to reduce losses of juvenile anadromous fish resulting from unscreened or inadequately screened diversions in the Sacramento-San Joaquin Delta and Suisun Marsh, if Evaluation 12 determines significant benefits to juvenile anadromous fish can be achieved by screening.	Diverters, CDFG, CDWR, USFWS, USBR, NMFS, SWRCB, COE	3406(b)(21)	Medium
*16. Construct and operate a barrier at the head of Old River to improve conditions for chinook salmon migration and survival if Evaluation 1 determines that a barrier can be operated to improve conditions for salmon with minimal adverse effects on other Delta species.	CALFED agencies	3406(b)(2), 3406(b)(3), 3406(b)(15)	High[2]

[2]Although Supplemental Action 16 addresses fish passage, it was assigned high priority because potential to increase fish production is great.

Evaluation	Involved parties	Tools	Priority
*1. In conjunction with Evaluation 2, evaluate whether a temporary rock barrier at the head of Old River can be operated during the 30-day April through May pulse flow period to improve conditions for chinook salmon migration and survival with minimal adverse effects on other Delta species, consistent with the COE's permit (PN 199600027) to the CDWR and USFWS's Biological Opinion on delta smelt for the Temporary Barriers Project.	IEP agencies	3406(b)(15)	High[1]
*2. Evaluate in conjunction with Evaluation 1 the impacts of San Joaquin River Delta inflow and SWP and CVP export rates on salmon smolt survival through the San Joaquin Delta. This evaluation is intended to be consistent with the proposed adaptive management plan for the San Joaquin River and Delta that is being considered by involved parties.	IEP agencies	3406(b)(1), 3406(b)(2), 3406(b)(3)	High
*3. Evaluate the effect of a low (~35%) versus a high (~65%) SWP and CVP export to Delta inflow ratio on the survival of coded-wire-tagged, late-fall-run chinook salmon smolts migrating through the Delta when the DCC is closed.	IEP agencies	3406(b)(1), 3406(b)(2), 3406(b)(3)	High
*4. Evaluate potential benefits of and opportunities for increasing salmonid and other anadromous fish production through improved riparian habitats in the Delta.	SWP and CVP contractors, TNC, IEP agencies	3406(e)(1)	High

[1]Although Evaluation 1 addresses fish passage, it was assigned high priority because resulting information is needed before Supplemental Action 16 can be implemented.

Evaluation	Involved parties	Tools	Priority
*5. Evaluate opportunities to provide modified operations and a new or improved control structure for the DCC and Georgiana Slough or other methods at those locations to assist in the successful migration of anadromous salmonids.	SWP and CVP contractors, IEP agencies	3406(b)(14), 3406(e)(5)	High[2]
*6. Evaluate benefits of and opportunities for additional tidal shallow-water habitat as rearing habitat for anadromous fish in the Delta.	SWP and CVP contractors, TNC, IEP agencies		High
7. Evaluate the benefit of and opportunities for new technologies to improve water quality and to guide migrating fish.	SWP and CVP contractors, IEP agencies		Medium
*8. Evaluate the benefits of short-term pulsed Delta inflows (five days or less) on the migration rate and survival of anadromous fish.	SWP and CVP contractors, IEP agencies		High
*9. Continue to evaluate the effects of Delta hydraulic conditions such as net reverse flows on anadromous fish migration and distribution.	SWP and CVP contractors, IEP agencies	3406(g)	High
10. Evaluate the potential effects of reductions in food chain organisms in the Delta and Suisun Bay on anadromous fish production.	SWP and CVP contractors, IEP agencies	3406(g)	High

[2]Although Evaluation 5 addresses fish passage, it was assigned high priority because the potential to increase fish production is great.

Evaluation	Involved parties	Tools	Priority
*11. Evaluate whether Delta inflow and export rates and other Delta hydrodynamic parameters effect juvenile salmon survival when the DCC is closed.	SWP and CVP contractors, IEP agencies	3406(g)	High
12. Evaluate the benefits to juvenile anadromous fish of and opportunities for screening diversions and re-locating riparian diversions in the Delta and Suisun Marsh.	SWP and CVP contractors, IEP agencies	3406(b)(21)	Medium
*13. Evaluate the potential effect of Delta export rate during the fall on the upstream migration of adult San Joaquin chinook salmon.	SWP and CVP contractors, IEP agencies	3406(b)(1)(B)	High

CENTRAL VALLEY-WIDE

Action	Involved parties	Tools	Priority
*1. Support programs to provide educational outreach and local involvement in restoration, including programs like Salmonids in the Classroom, Aquatic Wild, and Adopt a Watershed and school district environmental camps.	Local schools, CDFG, USFWS, NMFS		Low
2. Develop programs to educate the public about anadromous fish issues, such as the effects of poaching and environmental contaminants, especially contaminants in urban runoff.	CDFG, USFWS, NMFS, Water Education Foundation, California Teachers Association		Low

Action	Involved parties	Tools	Priority
3. Reduce toxic chemical and trace element contamination.	CDFG, USFWS, SWRCB, RWQCBs		High
*4. Provide additional funding for increased law enforcement to reduce illegal take of anadromous fish, stream alteration, and water pollution and to ensure adequate protection for juvenile fish at pumps and diversions.	CDFG, USFWS, USBR, CDWR		High

Evaluation	Involved parties	Tools	Priority
1. Evaluate the need to revise harvest regulations to increase spawning escapement of naturally produced chinook salmon.	CDFG, Pacific Fisheries Management Council (PFMC), NMFS, USFWS		Low
2. Evaluate the potential to modify hatchery procedures to benefit native stocks of salmonids.	CDFG, CDWR, USFWS, USBR	3406(e)(2)	Low
3. Evaluate and avoid potential competitive displacement of naturally produced juvenile salmonids with hatchery-produced juveniles by implementing release strategies for hatchery-produced fish designed to minimize detrimental interactions.	CDFG, CDWR, USFWS, USBR	3406(e)(2)	Low
*4. Evaluate and implement specific hatchery spawning protocols and genetic evaluation programs to maintain genetic diversity in hatchery and natural stocks.	CDFG, CDWR, USFWS, USBR	3406(e)(2)	Low
5. Evaluate the transfer of disease between hatchery and natural stocks.	CDFG, CDWR, USFWS, USBR	3406(e)(2)	Low

Evaluation	Involved parties	Tools	Priority
6. Evaluate effects of trace elements and organic contaminants, especially selenium and PCBs, on the health of adult white sturgeon and green sturgeon, the viability of their gametes, and development of their offspring.	CDFG, USFWS		High
*7. Evaluate a program to tag and fin-clip all or a significant portion of hatchery-produced fish as a means of collecting better information regarding harvest rates on hatchery and naturally produced fish and effects of hatchery-produced fish on naturally produced fish.	CDFG, CDWR, USFWS, USBR, NMFS, EBMUD	3406(e)(2)	Low
8. Evaluate the direct and indirect effects of contaminants on production of anadromous fish.	CDFG, USFWS, RWQCBs, SWRCB		High
9. Evaluate the ability of streams for which target production levels exist for chinook salmon but not for steelhead to support natural production of steelhead.	CDFG, USFWS	3406(e)(6)	High
10. Evaluate the effects of exotic species on production of anadromous fish.	IEP agencies		Low
11. Encourage the restoration of small tributaries by evaluating the feasibility of screening or relocating diversions, switching to alternative sources of water for upstream diversions, restoring and maintaining a protected riparian strip, limit excessive erosion, enforcing dumping ordinances, removing toxic materials or controlling their source, replacing bridge and ford combinations with bridges or larger culverts and installing siphons to prevent truncation of small streams at irrigation canals.	CDFG, USFWS, USBR	3406(e)(6)	High

OCEAN

Evaluation	Involved parties	Tools	Priority
1. Evaluate the need to revise harvest regulations on both sport and commercial fishers to increase spawning escapement of naturally produced chinook salmon.	PFMC, CDFG, NMFS, USFWS		Low
2. Evaluate the effects of sea lion predation on chinook salmon production.	PFMC, CDFG, NMFS, USFWS		Low
3. Evaluate the effects of foreign, open-ocean harvest on Central Valley chinook salmon and steelhead stocks.	PFMC, NMFS, CDFG, USFWS		Low

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APPENDICES

A. AFRP Position Paper

Presented in its entirety below is the "Position Paper for Development of the Central Valley Anadromous Fish Restoration Program". The Position Paper was developed by the AFRP Core Group to guide program development. It was released to the public on July 18, 1994 and was slightly revised and re-released in Volume 2 of the Working Paper on Restoration Needs (USFWS 1995). Only the phone number and address to request copies has been revised since the last release.

POSITION PAPER FOR DEVELOPMENT OF THE CENTRAL VALLEY ANADROMOUS FISH RESTORATION PROGRAM

INTRODUCTION

The Plan of Action (POA) for the Central Valley Anadromous Fish Restoration Program (Program) identifies the steps necessary to develop the Program (USFWS 1994). One of the steps included the preparation of a Position Paper to be developed by the Core Group. This document is a draft of the Position Paper described in the POA.

This Position Paper is a reference document for use by the Core Group and the technical teams to guide Program development. Because it was impossible to anticipate all issues prior to drafting the Position Paper, this paper will be amended and supplements added as needed. To determine if your copy is current and to request copies of the Position Paper, contact the Public Information Officer, Central Valley Fish and Wildlife Restoration Program, 3310 El Camino Avenue, Sacramento, California 95821, (916) 979-2760.

The paper is divided into three sections: (1) Program goal and definitions, (2) Intent of Title 34, and (3) Implementation criteria. The first section states the Program goal and develops general definitions for each of the terms used in the Program goal. The second section presents and interprets the intent of Title 34 and reexamines some of the definitions presented in the first section. These first two sections lay the foundation for the last section.

In the last section, implementation criteria are discussed for the 1967-1991 (baseline) period and for the future. Discussions of implementation criteria are separated because the two periods require different criteria. As discussed later in this paper, limitations are imposed by the type or quantity

of data collected during the baseline period. Future monitoring programs may be designed to avoid these limitations.

PURPOSE OF POSITION PAPER

The purposes of the Position Paper are two-fold: (1) to explain or clarify the Core Group's position on issues related to developing the Program and (2) to document reasons used to develop these positions.

PROGRAM GOAL AND RELATED DEFINITIONS

Title 34 requires that "...natural production of anadromous fish in Central Valley rivers and streams be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991..." (Section 3406[b][1]). Several terms need to be clearly defined before the program can be designed to meet this requirement: natural production, anadromous fish, Central Valley rivers and streams, sustainable, long-term basis, and average levels.

Natural Production

Title 34 defines natural production as: "... fish produced to adulthood without direct human intervention in the spawning, rearing, or migration processes" (Section 3403[h]). To apply this definition, we must develop an understanding of the meaning of each of the components of the definition. Important components that have been identified to date are the following: production, adulthood, and direct human intervention.

Production

Ricker (1958) defined production as "the total elaboration of new body substance in a stock in a unit of time, irrespective of whether or not it survives to the end of that time." Although Ricker's definition includes changes in mass as well as numbers of fish, Title 34 specifies "... fish produced to adulthood..." and therefore production will refer to numbers of fish produced.

Because a fish can only be "...produced to adulthood..." once in its lifetime, an individual fish should not be counted twice. In addition, production should be measured over a discrete time interval. Because all stocks under consideration are seasonal spawners, **a direct and simple approach will be to count the first-time spawners each spawning season**.

Ricker's definition also states that a fish is counted toward production for the time period over which production is being measured "...irrespective of whether or not it survives to the end of that time". Using Ricker's definition, juvenile fish that did not survive to adulthood would be counted. The definition of natural production in Title 34 specifies "... fish produced to adulthood..." and therefore does not count juvenile fish. On the other hand, Title 34 does not discriminate between adult fish that return to spawn and those taken in recreational and commercial fisheries. Because Ricker's definition includes fish that do not survive to the end of the time period, and because the definition of natural production in Title 34 specifies fish produced to adulthood, **all naturally produced, adult fish shall be counted, including those that are harvested prior to spawning**.

Including harvested fish is consistent with the definition of production in the California Salmon, Steelhead Trout and Anadromous Fisheries Program Act. The California Act defines production as "the survival of fish to adulthood as measured by abundance of the recreational and commercial catch together with the return of fish to the states spawning streams." Because both the Federal and State acts have similar purposes and goals, and because implementation of both acts should be coordinated, it is convenient that the definitions of production being implemented for both acts are similar.

Whether or not a fish attains adulthood is key to determining whether or not to count that fish toward the production goal. Adulthood is defined below.

Adulthood

Section 3403(h) includes the phrase "...fish produced to adulthood..." as part of the definition of natural production. Adulthood is not defined within Title 34. Adulthood is generally defined as the state, condition or quality of being fully developed and mature. Applying this definition to fish is complicated by the fact that most fish continue to grow throughout life (i.e., cessation of growth can't be used to indicate full development) and may become sexually mature several times during their lifetime (i.e., although developed gonads can be used to indicate maturity, lack of developed gonads cannot be used to indicate immaturity). Because the presence or absence of external characters can't always be used to identify adult fish, and because sexual maturity (i.e., developed gonads) is a transitory state, fishery managers often use size or age criteria to indicate maturity.

An adult fish will be defined as one that is capable of reproduction. Ability to reproduce should be based on some external characteristic, such as size. Because Title 34 requires that production be compared between baseline and goal periods, the same criteria for determination of adulthood will be applied to both periods.

Direct Human Intervention

The definition of natural production precludes "...direct human intervention..." in the spawning, rearing, or migration processes of an individual, naturally produced fish. A definition of direct human intervention is key to understanding the definition of natural production. Humans have pervasively intervened in the structure and function of the Sacramento-San Joaquin system. All anadromous fish that spawn in the system have been impacted by this intervention. Indeed, Title 34 has as one of its purposes "...to address impacts of the Central Valley Project on fish, wildlife, and associated habitats..." (Section 3402[b]). But not all human intervention is direct. The word direct is an important component of the phrase "...direct human intervention...".

Direct human intervention is any action taken in the absence of intervening elements. Any form of intervention that requires handling of fish is direct intervention due to a lack of intervening elements. Any action that includes one or more intervening elements would be considered indirect intervention.

Hatchery and artificial propagation, including supplementation and outplanting of eggs or any other life-stage, requires handling of fish by humans during the spawning and rearing processes and therefore are forms of direct intervention. Transporting fish, including truck and barge transport, and fish salvage require capture and handling of fish during the rearing or migration process and therefore are forms of direct intervention. Hatchery and artificial propagation, transport and salvage of fish, or any process that requires handling of any life-stage of fish will be considered direct human intervention.

Title 34 clearly states that fish produced with direct human intervention should not be included in counts of natural production. In developing the Program, we will avoid counting hatchery-produced fish or fish produced with any other form of direct human intervention in counts of natural production. The Core Group has determined that there will be one exception to this rule: the progeny of naturally spawning fish salvaged at the John E. Skinner Delta Fish Protective Facility and the Tracy Fish

Protective Facility, if they reach adulthood, will be counted as naturally produced.

An example of a form of intervention that does not fit the definition of direct intervention is flow manipulation. When we manipulate flow to benefit fish, flow acts as the intervening element. Humans directly alter flows and flows alter fish spawning, rearing, or migration processes. Therefore, flow manipulation is not a direct but an indirect form of intervention. Construction of fish ladders, screens and barriers are forms of indirect intervention because each of these structures act as the intervening element. Reservoir or flow manipulations (including Delta flows and flows to maintain desired stream temperatures), ladders, screens, barriers, and other forms of habitat alteration and enhancement activities will not be considered direct human intervention because each of these is or has an intervening element and does not require handling of fish.

Because the definition of natural production in Title 34 includes the phrase "...produced to adulthood...", fish that are not subject to direct human intervention until after they reach adulthood would still be considered naturally produced. For example, a naturally produced fish that returned to a hatchery and was spawned in the hatchery would be considered naturally produced. Obviously, its progeny would not be considered naturally produced because they were produced in a hatchery. Similarly, naturally produced adult fish whose migration was subject to direct human intervention would still be considered naturally produced, although their progeny would not be considered naturally produced.

Anadromous Fish

Title 34 defines anadromous fish as "...those stocks of salmon (including steelhead), striped bass, sturgeon, and American shad that ascend the Sacramento and San Joaquin rivers and their tributaries and the Sacramento-San Joaquin Delta to reproduce after maturing in San Francisco Bay or the Pacific Ocean" (Section 3403[a]). This definition identifies five groups or species of fish: salmon, steelhead, striped bass, sturgeon, and American shad. The American Fisheries Society recognizes steelhead as the common name for the anadromous form of *Oncorhynchus mykiss* and striped bass and American shad as the common names for *Morone saxatilis* and *Alosa sapidissima* (AFS 1991). Clearly, Title 34 includes these species in the definition of anadromous fish. The names salmon and sturgeon both include multiple species of fish and the meaning of these terms in relation to Program development needs clarification. The term "stocks" in the definition of anadromous fish also needs clarification.

Salmon - Salmon is a common name for at least six species of fish. Five species of salmon have been observed in the Sacramento River: chinook (*O. tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), pink (*O. gorbuscha*), and chum (*O. keta*) salmon (Moyle 1976, Fry 1973). Chinook salmon are common in the Sacramento-San Joaquin system, the other four species are rare. Based on observations of adults during 1949 through 1958, Hallock and Fry (1967) concluded that sockeye, pink, and chum salmon entered the Sacramento River regularly enough to be regarded as very small runs, but that coho salmon were so scarce and irregular that they should be regarded as strays. Juvenile coho salmon were planted in Mill Creek in 1956, 1957, and 1958, but by 1963 coho salmon were almost as scarce as they had been before the introductions (Hallock and Fry 1967). During the baseline period, there is no evidence that coho, sockeye, pink, or chum salmon maintained self-sustaining spawning runs in the Central Valley (Fisher pers. comm.). Because the definition of anadromous fish specifies "...salmon... that ascend the Sacramento and San Joaquin rivers...to reproduce..." and because chinook salmon is the only salmon known to reproduce in the system on a regular basis during the baseline period, the use of the word salmon in the definition will be interpreted to mean chinook salmon.

Sturgeon - Two species of sturgeon are found in the Sacramento-San Joaquin system: white sturgeon (*Acipenser transmontanus*) and green sturgeon (*A. medirostris*) (Moyle 1976). Because both species of sturgeon reproduce in the Sacramento-San Joaquin system, the word sturgeon will be interpreted to include white and green sturgeon.

In summary, **the species of anadromous fish identified by Title 34 that reproduce in the Sacramento-San Joaquin system include chinook salmon, steelhead, striped bass, white sturgeon, green sturgeon, and American shad**. The Program will be designed to double the natural production of the anadromous forms of these six species.

Other anadromous fish - Title 34 does not identify several species of anadromous fish that spawn in Central Valley rivers and streams. These include threespine stickleback, brown trout, and two species of lamprey and smelt (Fry 1973). The Program will not establish restoration goals specific to these species.

Stocks

For purposes of the Program, **a stock is defined as a group of individuals which are more likely to mate with each other than with individuals not included in the group**. The term stock describes a fish

population that spawns in a particular stream, or stream reach, at a particular season and that do not interbreed to a substantial degree with any group spawning in a different place, or in the same place at a different time. This definition does not rely upon absolute reproductive barriers. In fisheries management, stocks are recognized to maintain and improve the genetic basis for management.

Several stocks which meet this definition are already recognized. For example, chinook salmon are divided into several races based on the season during which they enter the rivers to begin their upstream spawning migrations as follows: fall, late-fall, winter, and spring runs. Others stocks which might be recognized in the future will likely become stocks of special concern.

Good evidence exists for salmon and steelhead that these species return to their natal streams to spawn. There is some evidence and little reason not to expect that the same relationship holds for some of the other anadromous species. As stated in the POA for the Program, the objective of the Program will be to double the natural production of all species and races within specific individual streams, and **to preserve genetic stocks**. If it proves unfeasible to double the natural production of a species or race within a specific stream, the unmet production increment will be transferred to other individual streams in the following order of priority: (1) another stream within the same drainage system, (2) another stream within the larger basin, such as the Sacramento River Basin, and (3) any stream within the Central Valley.

Central Valley Rivers and Streams

For the purposes of the Program, **Central Valley rivers and streams are defined as all rivers, streams, creeks, sloughs and other watercourses, regardless of volume and frequency of flow, that drain into the Sacramento River basin, the San Joaquin River basin downstream of Mendota Pool, or the Sacramento-San Joaquin Delta upstream of Chipps Island**.

Sustainable

Sustainable means capable of being maintained or kept in existence. In Title 34, sustainable refers to natural production, which is defined as "... fish produced to adulthood without direct human intervention...." Elimination of direct human intervention as a legitimate alternative requires reliance on restoration and maintenance of habitat conditions that allow anadromous fish populations to sustain themselves at levels consistent with

numeric restoration goals. Therefore, in the context of Title 34, **sustainable is defined as capable of being maintained at target levels without direct human intervention in the spawning, rearing or migration processes**. Production levels specified by numeric goals will be considered sustainable when they are maintained under the entire range of conditions resulting from legal human activities, as superimposed on natural variability inherent in the system. Human activities shall include, but not be limited to, agricultural diversion and discharge, exports, flow manipulation, water pollution, dredge and fill, channel modification and damming.

There is an element of time implicit in sustainability. Therefore, if natural production is to be sustainable, modifications to system operations as well as improved physical habitat and water quality must be provided into the future. Title 34 requires that "...natural production...be sustainable, on a long-term basis" and provides for annual funding without a specified expiration date. The intent of Title 34 is that numeric restoration goals continue to be realized or exceeded in perpetuity.

Long-Term Basis

Long-term will encompass at least several generations of fish (not less than 5) over a variety of hydrologic conditions (to allow for natural variation in production) and will continue indefinitely.

Average Levels

As stated in Title 34, the goal is to sustain natural production "...at levels not less than twice the average levels attained during the period of 1967-1991..." To attach numeric values to this goal, we need to estimate average levels of production. One problem is that average is not a precise statistical term. In statistics, the term average can apply to several measures of central tendency (Langley 1971). The most commonly used measure of central tendency is the arithmetic mean (Lapin 1975). Consequently, the public generally understands average to mean arithmetic mean and it is reasonable to assume that this was the intent of the authors of Title 34. Therefore, **the definition of average will be the arithmetic mean**.

INTENT OF TITLE 34

Habitat Restoration

Of the six purposes of Title 34, three are particularly germane to discussion of the intent of Title 34 as it relates to the Program. These three purposes are listed below:

(1) to protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California (3402[a]);

(2) to address impacts of the Central Valley Project on fish, wildlife and associated habitats (3402[b]);

(3) to contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (3402[e]);

In addition, Section 3406(b)(1)(A) states that the Program "...shall give first priority to measures which protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to Central Valley Project operations, and implementation of the supporting measures mandated by this subsection..." Because Title 34 directs that the Program shall emphasize habitat restoration, **emphasis will be placed on restoring habitat**.

Natural versus Hatchery Production

Title 34 requires that "...natural production of anadromous fish in Central Valley rivers and streams be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991..." (Section 3406[b][1]). The requirement that natural production be sustainable on a long-term basis suggests that the intent of Title 34 is for the definition of natural production to extend between generations of fish. Natural production should be self-sustaining. **The Program should not depend on hatchery-produced fish to sustain populations of naturally spawning fish**.

In addition, Title 34 requires investigations of "...opportunities for additional hatchery production to mitigate the impacts of water development and operations on, or enhance efforts to increase Central Valley fisheries; Provided, That additional hatchery production shall only be used to supplement or to re-establish natural production while avoiding

adverse effects on remaining wild stocks" (Section 3406[e][2]). This section provides insight into the intent of Title 34 as it relates to the roles of natural and hatchery production and emphasizes avoiding adverse effects of hatchery production on wild (naturally produced) stocks. Under Title 34, **hatchery production should only be used as a last resort to supplement or to re-establish natural production, and then only after investigations on the desirability of developing and implementing additional hatchery production**.

Adverse effects of hatchery production on natural stocks can include reductions in population size caused by competition, predation, disease or other factors (Sholes and Hallock 1979, Waples 1991). A large potential for negative interaction exists when these stocks interbreed (Hindar et al. 1991, Taylor 1991, Waples 1991). The adverse effects of interbreeding increase as hatchery-produced fish become more prevalent in the naturally spawning population. Interbreeding reduces interpopulation diversity and may lead to a reduction in overall productivity and a greater vulnerability to environmental change (Waples 1991). Outbreeding depression may also result from interbreeding. In addition, large populations of hatchery-produced fish that are indistinguishable from naturally produced fish may intensify effects of harvest on naturally produced fish (Wright 1993). The simplest way to avoid adverse effects on naturally produced stocks is to minimize the opportunities for interaction between naturally and hatchery-produced fish. **The Program should be designed to avoid adverse effects of hatchery production on natural stocks**.

Harvest

Title 34 does not directly address harvest. Title 34 defines natural production as: "... fish produced to adulthood..." (Section 3403[h]) and requires that natural production be increased. Inclusion of the term production, and especially production to adulthood, suggests that **Title 34 does not intend for restriction of harvest to be used as a means of achieving Program goals**. As stated in the definition of production, harvested fish should be included in counts of production. Sound harvest management is designed to harvest only excess production, allowing for enough fish to escape harvest to maintain production at the highest level the habitat can support.

Title 34 requires that natural production be increased. There are two mechanisms by which natural production can be increased: (1) increasing the productivity of the existing habitat, and (2) increasing the amount of habitat. These mechanisms are consistent with the emphasis Title 34 places on habitat restoration. Doubling productivity of existing habitat would

provide more offspring from the same number of spawners. If existing spawning habitat is being fully utilized, then increasing the number of spawners by reducing harvest would not increase production. If production of naturally produced fish is doubled and escapement is held to present levels, then harvest of naturally produced fish could more than double.

The second mechanism, doubling the amount of habitat, would accommodate twice the number of spawners. This would also provide twice the number of offspring. Under this scenario, harvest of naturally produced fish could double. Under either mechanism, barring other harvest restrictions, we would expect at least a doubling of harvest of naturally produced fish. To meet the Intent of Title 34, **harvest should be maintained at levels that allow sufficient numbers of naturally produced fish to spawn to meet goals for at least doubling natural production**.

IMPLEMENTATION CRITERIA

As stated earlier, criteria for determination of natural production will conform to the definition of natural production and intent of Title 34, including definitions and interpretations of intent discussed and refined in this Position Paper. Because determination of natural production in the past will require different criteria than in the future, criteria for these time periods will be discussed separately.

Criteria for the baseline period

In the past, data collection efforts have not focused on estimating natural production and existing data may not provide direct estimates of natural production. In order to establish numerical goals for the Program, average levels of natural production must be estimated for the baseline period. Estimates will require assessing existing data and developing criteria to determine which data are germane. Criteria may not strictly conform to the definitions in and intent of Title 34 but are a compromise necessitated by a lack of data on natural production.

As explained in the POA, the Core Group and technical teams are responsible for developing these criteria. Technical teams are asked to develop initial criteria and estimates of average levels of natural production for the baseline period.

Where data are lacking, technical teams will make assumptions to expand existing data, or put existing data in perspective. For example, run-size

estimates for American shad exist for only two years. In addition, young American shad abundance has been sampled during the fall emigration each year since 1967, except for 1974 and 1979 (Mills and Fisher, in preparation). The American shad technical team could look at young American shad abundance data to determine if run-size estimates for adults are representative of the abundance of shad for the baseline period. This approach has assumptions (chief among these is that abundance of young American shad can tell us something about average adult run-sizes) which are probably violated to some degree and is only presented as an example of what might be considered. Technical teams will document options considered for estimating natural production in issue papers that will be appended to the Program Plan if not in the text. Data quantity and applicability toward estimating natural production varies between species and drainage. Each technical team will need to address these issues for each species and drainage separately. Criteria for determining natural production during the baseline period will be applicable to existing data.

Because there is a relative wealth of data for chinook salmon and because several Teams deal with chinook salmon, specific criteria are proposed for them. Most of the data necessary to estimate production of each stock of chinook salmon for the baseline period are compiled in Mills and Fisher (1994). The proposed procedure for estimating yearly production of each race of chinook salmon for each stream during the baseline period follows.

In the following explanations and formulas, P is for production, E is for escapement, H is for harvest, and *h* is for the portion of total production not produced naturally. Subscripted letters following the normal letters and prior to the first comma represent different races of chinook salmon as follows: F for fall, L for late-fall, W for winter, S for spring, and C for all races combined. Subscripted letters following the first comma represent the following: O for ocean, D for downstream, I for instream, N for natural, H for hatchery, and T for total. Subscripted letters following the second comma represent the following: CV for Central Valley, SF for San Francisco, M for Monterey, and other letter combinations correspond to specific streams (e.g., AM for American River). Subscripted letters following a third comma refer only to ocean harvest and are C for commercial and R for recreational. In all cases, a subscripted X acts as a "wildcard" place holder for an unspecified subscript.

1. A portion of production returns to spawn in each stream, both naturally and in the hatchery. Some of these fish are captured before spawning. These fish are counted toward production for the stream in which they spawned or were harvested according to the following:

a. To determine the total spawning escapement ($E_{i,xx}$) for each race in each individual stream, sum the estimated number of each race of chinook salmon returning to spawn naturally ($E_{i,xx}$) and in hatcheries ($E_{i,xx}$) for each individual stream, $E_{i,xx} = E_{i,xx} + E_{i,xx}$, to the estimated number of each race of chinook salmon harvested in each stream ($H_{i,xx}$), add $E_{i,xx}$ to the portion of production for each race returning to each stream (in-river run-size, $P_{i,xx}$). Estimates of $H_{i,xx}$ do not exist for all streams and all years. Where estimates are not available or are inadequate, best professional judgement must be used. Technical Teams should document options considered for estimation of $H_{i,xx}$ in the Program Plan or in issue papers that will be appended to the Program Plan.

b. To determine the portion of production for each race returning to each stream ($P_{i,xx}$), sum $P_{i,xx}$ for all streams in the Central Valley ($\Sigma P_{CV,xx}$).

c. To determine the total number of each race of chinook salmon returning to the Central Valley ($P_{CV,xx}$), sum $P_{i,xx}$ for all races of chinook salmon ($\Sigma P_{CV,xx} = \Sigma P_{i,xx}$).

d. To determine the total number of chinook salmon (all races combined) returning to the Central Valley (P_{CV}), sum $P_{CV,xx}$ chinook salmon ($\Sigma P_{CV} = \Sigma P_{CV,xx}$).

2. A portion of production is harvested in the ocean and downstream of areas in rivers where the stream responsible for this production is not easily identified. To assign these harvested salmon to individual streams, the total number of salmon falling into this category is summed and subdivided to race and stream, proportional to the portion of production attributed to each race and returning to each stream, according to the following:

a. To determine the Central Valley component of ocean harvest ($H_{CC,CV}$), sum commercial catch at San Francisco ($H_{CC,C}$) and Monterey ($H_{CC,R}$), sum recreational catch at these same ports ($H_{CR,C}$ + $H_{CR,R}$), and add these together. This estimate of $H_{CC,CV}$ is based on the Central Valley Index (CVI), where harvest of Central Valley stocks equals landings at major ports south of Point Arena (San Francisco and Monterey). Use of CVI to estimate the Central Valley component of ocean harvest assumes that the number of

Central Valley chinook salmon harvested from ports north of San Francisco is balanced by the number of chinook salmon from drainages north of the Central Valley harvested from San Francisco and Monterey. To carry forward in subsequent calculations, assume that each chinook salmon harvested in the ocean fishery is equivalent to an adult salmon returning to spawn.

b. To account for that portion of inland harvest that occurs downstream of streams for which production is being estimated, estimate portion of inland recreational harvest captured downstream of spawning streams (). Information necessary to estimate may not be available. If an estimate exists, use it. If an estimate of inland harvest for the entire Central Valley exists (), then sum all assignable inland harvest (3) to determine . If other options exist, these should be explored. could be assumed to be small and therefore left out of the calculations or could be included in , in which case it would already to assigned to an individual stream.

c. To determine ocean and downstream inland harvest for the Central Valley () to each), sum to specific races, subdivide

d. To assign portions of ( ) to the portion of production for all races race, proportional to the portion of production for each race returning to the entire Central Valley ( ). to combined returning to the entire Central Valley ( ) to specific streams, subdivide

e. To assign portions of ( ) to the portion of production for that race each stream, proportional to the portion of production for that race returning to each stream ( ). returning to the entire Central Valley ( ), sum .

3. To determine total production for each race and stream (and

4. A portion of the total production was not produced naturally (h). For the baseline period, only hatchery-produced salmon will be considered to be produced by other than natural means. To determine the natural production for each individual stream ($P_{i,xx}$), multiply $P_{i,xx}$ by (1-h). Technical Teams should document options considered and chosen for estimation of h in issue papers that will be appended to the Program Plan or in the text for the Program Plan.

$$P_{i,xx} \times (1-h) = P_{i,xx}$$

for each of the years during the baseline period. Numeric restoration goals for chinook salmon in each stream will be calculated as at least double the average of $P_{i,xx}$.

Criteria for the future

In the future, opportunities exist to improve estimates of natural production. These range from augmenting historic data collection activities with efforts to estimate the proportion of fish that are naturally produced, to designing new data collection to better account for natural production. The Core Group and technical teams are responsible for designing future monitoring programs.

The Core Group and technical teams have and will identify deficiencies in the baseline data. Future monitoring activities will be designed to address and avoid deficiencies. For example, monitoring programs should focus on estimating production, including harvest, on a consistent and regular basis, preferably yearly, in all of the streams in the Central Valley.

Monitoring programs should also estimate natural production, requiring some means of separating naturally produced fish from fish produced by other than natural means. At the very least, natural production must be discernable from hatchery production. Several methods can be used to separate naturally produced fish from hatchery-produced fish, including use of scale (Scarnecchia and Wagner 1980) or otolith (Paragamian et al. 1992) characteristics and constant fractional (Hankin 1982) or complete marking of hatchery-produced fish (Wright 1993), including incorporation of genetic markers (Waples 1991), inducement of otolith banding patterns (Volk et al. 1990), and more standard methods such as clipping fins. In addition, recommendations for the future should include managing naturally and hatchery-produced fish separately.

In addition, better estimates of harvest of Central Valley salmon in the ocean and of all anadromous fish in the Bay, Delta, and in each individual river and stream in the Central Valley should be developed. Harvest should be monitored continually.

CITATIONS FOR POSITION PAPER

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B. Production targets for chinook salmon in each stream

Preliminary estimated production targets for chinook salmon. Data for rivers without a race designation are for fall-run chinook salmon.

Race and river	Production targets
All races combined[a]	990,000
Fall run	750,000
Late-fall run	68,000
Winter run	110,000
Spring run	68,000
Sacramento River	
Fall run	230,000
Late-fall run	44,000
Winter run	110,000
Spring run	59,000
Clear Creek	7,100
Cow Creek	4,600
Cottonwood Creek	5,900
Battle Creek	
Fall run	10,000
Late-fall run	550
Paynes Creek	330
Antelope Creek	720
Mill Creek	
Fall run	4,200
Spring run	4,400
Deer Creek	
Fall run	1,500
Spring run	6,500
Miscellaneous creeks	1,100
Butte Creek	
Fall run	1,500
Spring run	2,000
Big Chico Creek	800
Feather River	170,000
Yuba River	66,000
Bear River	450
American River	160,000
Mokelumne River	9,300
Cosumnes River	3,300
Calaveras River	
Winter run	2,200
Stanislaus River	22,000
Tuolumne River	38,000
Merced River	18,000

[a]Targets for each of the races of chinook salmon may not add up to the target for all races combined due to rounding.

C. Contacts and sources of information.

For information on the Anadromous Fish Restoration Program, contact:

Martin A. Kjelson, Program Manager
U.S. Fish and Wildlife Service
Anadromous Fish Restoration Program
Sacramento-San Joaquin Estuary Fishery Resource Office
4001 North Wilson Way
Stockton, CA 95205
(209) 946-6400
E-mail address: martin_kjelson@fws.gov

For information on the Central Valley Fish and Wildlife Restoration Program, including information on other sections of the CVPIA that contribute to fish and wildlife restoration, contact:

James J. McKevitt, Program Manager
U.S. Fish and Wildlife Service
Central Valley Fish and Wildlife Restoration Program
3310 El Camino Avenue
Sacramento, CA 95821
(916) 979-2760
E-mail address: jim_mckevitt@fws.gov

For information on the CALFED Bay-Delta Program's near-term efforts to restore anadromous fish in the Central Valley, especially funding for restoration actions, contact:

Cindy Darling or Kate Hansel, Restoration Coordinators
CALFED Bay-Delta Program
Restoration Coordination Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814
(916) 657-2666 or 653-1103
E-mail address: cdarling@water.ca.gov or hanselk@water.ca.gov

For information on the CALFED Bay-Delta Program's long-term plan for ecosystem restoration, contact:

Dick Daniel, Assistant Director or
Terry Mills, Ecosystem Restoration Program Plan Manager
CALFED Bay-Delta Program
Ecosystem Restoration Program Plan
1416 Ninth Street, Suite 1155
Sacramento, CA 95814
(916) 657-2666
E-mail address: ddaniel@water.ca.gov

For information on the California Department of Fish and Game's efforts to restore anadromous fish in the Central Valley, contact:

Alan Baracco
California Department of Fish and Game
Inland Fisheries Division
1416 Ninth Street
Sacramento, CA 95814
(916) 653-4729

Copies of "Conservation Partnership: A Field Guide to Public-Private Partnering for Natural Resource Conservation" may be obtained from:

U.S. Fish and Wildlife Service
Office of Training and Education
4401 North Fairfax Drive
Arlington, VA 22203
(703) 358-1711

or

National Fish and Wildlife Foundation
1120 Connecticut Avenue, NW, Suite 900
Washington, DC 20036
(202) 857-0166

Copies of "California Coordinated Resource Management and Planning Handbook" may be obtained from:

CRMP Coordinator
California Association of Resource Conservation Districts
801 K Street, Suite 1318
Sacramento, CA 95814
(916) 447-7237
FAX (916) 447-2532

D. Template for organization of detailed information on specific actions

The AFRP has developed a draft template containing the following information for each of the actions listed in the Restoration Plan.

Watershed or geographic area: Identifies the drainage or geographic area under which the action or evaluation description appears in the Restoration Plan. *(Where)*

Watershed priority: Lists the priority as designated in the Restoration Plan for the watershed or geographic area, if applicable.

Action (or evaluation): Includes the text for the action or evaluation as it appears in the Restoration Plan, including the number assigned to the action or evaluation. *(What)*

Location: Identifies the specific location(s), if applicable, of the action or evaluation. Include the stream mile(s), city(ies) and county(ies) in which the action or evaluation would be taken. *(Where)*

AFRP action (or evaluation) priority: Lists the priority relative to other actions and evaluations in the drainage, as it appears in the Restoration Plan.

Objective: Briefly states the objective(s) of the action or evaluation. Identifies species or race(s) of anadromous fish primarily affected and problem(s) solved by or intended effect(s) of the action or evaluation. *(Why)*.

Description: Describes the action or evaluation in detail, including how the action or evaluation will be implemented. Cites any literature that may provide further detail. *(More detail on what and a description of how.)*

Background: Describes the existing information leading up to development of the action or evaluation, including discussion of alternative actions and of work done to date. Cites any literature that may provide further detail. *(More detail on why.)*

Justification: Describes the reasons for implementing the action or evaluation. Cites any literature that may provide further detail. *(More detail on why.)*

Monitoring needs: Identifies activities, including variables to observe, needed to evaluate the effectiveness of the action or to complete the evaluation.

Predicted biological benefits: Identifies anticipated biological benefits, preferably in quantitative terms, focusing on anadromous fish and their habitat.

Issues: Identifies factors potentially influencing initiation and completion of the action or evaluation. These issues may include design constraints, potential impacts of the action or

evaluation on the economy or on other segments of the ecosystem, ability to evaluate the success of the action or evaluation, or the inability of partners to secure funding. This section will also include identification and discussion of actions or evaluations that may increase or decrease the effectiveness of the action or evaluation described here.

Involved parties: Lists parties involved in implementing the action or evaluation. *(Who)*

Environmental documentation: Lists environmental documentation and permitting necessary to complete the action or evaluation. For example, list should include whether or not an EA and negative declaration or FONSI, an EIR, an EIS, or Biological Opinion is required. It will also list any county or municipal permits that may be required.

Deliverables: Lists products (e.g., initial design and feasibility reports, environmental documentation, progress reports, physical structures, and monitoring reports) that have been or will be completed as part of implementation and monitoring.

Schedule: Lists time frame for key events (e.g., start and completion dates for deliverables and other major activities necessary for implementation and monitoring) in chart format. Potential for schedule revisions should be identified. *(When)*

Estimated cost to completion: Lists total costs from planning to completion, including permits, environmental documentation, and monitoring. Potential for schedule and budget revisions will be identified. Both one-time and continuing annual costs will be identified.

Funding: Identifies funding sources (e.g., CVP Restoration Fund, Category III, Four Pumps Mitigation Agreement, specific public or private group, or individual) and funds committed each year to completion. Sources of both one-time and continuing annual funds will be identified, as available.

Status: Describes stage of development and accomplishments, and future activities and milestones, and impediments.

CVPIA implementation tools: Identifies applicable section(s) of the CVPIA.

Action coordinators: Identifies the coordinator(s) designated as an action manager or point of contact for each of the involved parties. If a lead coordinator exists, then it will note which coordinator is assigned lead. *(Who)*

Sources of information: Lists literature cited and additional sources of information on the action.

Report date: Lists date that the information was last updated.

E. Summary of information used to prioritize watersheds.

Table E-1. Production target for chinook salmon, presence of CVP flow control structures or facilities, and race or species present in each of the watersheds[1] for which actions are listed in the Restoration Plan.

River	Chinook salmon production target	CVP influence	Winter run	Spring run	Steelhead	Late-fall run	San Joaquin fall run	Fall run	Green sturgeon	White sturgeon	Striped bass	American shad
Sacramento River	990,000	X	X	X	X	X		X	X	X	X	X
Clear Creek	7,100	X			X			X				
Cow Creek	4,600			X[2]	X			X				
Cottonwood Creek	5,900			X	X	X		X				
Battle Creek	10,550	X	X[3]	X	X	X		X				
Paynes Creek	330				X			X				
Antelope Creek	720			X	X	X		X				
Mill Creek	8,600			X	X	X		X				
Deer Creek	8,000			X	X	X		X				
Misc. creeks	1,100				X			X				
Butte Creek	3,500			X	X	X		X				

[1]The presence of races or species in each of the watersheds is derived from CDFG's document titled "Restoring Central Valley Streams: A Plan for Action", dated November 1993, and authored by F.L. Reynolds, T.J. Mills, R. Benthin, and A. Low. Exceptions are footnoted.

[2]Although spring-run chinook salmon are sporadically observed in the Cow Creek watershed, there is no current potential for sustaining their production because of natural barriers and lack of over-summering holding pool habitat.

[3]Winter-run chinook salmon on Battle Creek are of hatchery origin.

River	Chinook salmon production target	CVP influence	Winter run	Spring run	Steelhead	Late-fall run	San Joaquin fall run	Fall run	Green sturgeon	White sturgeon	Striped bass	American shad
Big Chico Creek	800			X	X	X		X				
Feather River	170,000			X[4]	X			X	X	X	X	X
Yuba River	66,000			X	X			X				X
Bear River	450				X			X	X	X		
American River	160,000	X			X			X			X	X
Mokelumne River	9,300				X			X			X	X
Cosumnes River	3,300							X				
Calaveras River	2,200		X					X				
Merced River	18,000				X	X	X					
Tuolumne River	38,000				X[5]	X	X					
Stanislaus River	22,000	X			X	X	X				X	X
San Joaquin River	---	X					X		?	X	X	X
Sacramento-San Joaquin Delta	---	X	X	X	X	X	X	X	X	X	X	X

[4]The present Feather River Hatchery spring-run chinook salmon is a combination of fall-run and spring-run chinook salmon races (An evaluation of the Feather River Hatchery as mitigation for construction of the California State Water Project's Oroville Dam, Brown and Greene, Environmental Services Office, CDWR, 1995).

[5]Steelhead were observed in the Tuolumne River in 1983 (Bill Loudermilk, CDFG Senior Fishery Biologist, personal communication, and In CDFG, Steelhead restoration and management plan for California, D. McEwan and T.A. Jackson, 1996).

F. Projected funding resources.

The CVP Restoration Fund, along with additional agency and other partner funds, if available, will be used to implement the AFRP restoration actions. Funds available from the CVP Restoration Fund to the AFRP for actions, evaluations, monitoring and assessment during the 1997 federal fiscal year (FY97) totaled $10 million, and is expected to continue at about $8 to $10 million for each of the years in FY98 to FY2002. Additional Restoration Fund dollars carried over from previous years are also available to supplement AFRP funds, if needed. In addition, the Restoration Fund provides sufficient flexibility to move funds to areas of greatest need, subject to certain limitations. Specific funding allocations and estimates are described each year in annual work plans for the AFRP and in similar work plans for each of the other programs conducted pursuant to the CVPIA.

G. List of acronyms and abbreviations.

Acronym or abbreviation	Description
af	acre-feet
AFRP	Anadromous Fish Restoration Program, established by Section 3406(b)(1) of the CVPIA
AFS	American Fisheries Society
(b)(2) water	Water managed pursuant to 3406(b)(2), sometimes referred to as the 800,000 af or dedicated water
Bay-Delta	San Francisco Bay and Sacramento-San Joaquin Delta Estuary
BCWC	Butte Creek Watershed Conservancy
Bay-Delta Agreement	15 December 1994, Principles of Agreement on Bay-Delta Standards between the State of California and the Federal Government
BLM	Bureau of Land Management
CALFED	A California and federal multi-agency partnership
CALFED agencies	California California Environmental Protection Agency State Water Resources Control Board The Resources Agency Department of Fish and Game Department of Water Resources Federal Department of Commerce National Marine Fisheries Service Department of the Interior Bureau of Reclamation Fish and Wildlife Service Environmental Protection Agency
CAMP	Comprehensive Assessment and Monitoring Program, established by Section 3406(b)(16) of the CVPIA
CCRMP	California Coordinated Resource Management and Planning
CCWD	Calaveras County Water District
CDFG	California Department of Fish and Game
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
CNFH	Coleman National Fish Hatchery

Acronym or abbreviation	Description
COE	Corps of Engineers
Core Group	AFRP Core Group
CSLC	California State Lands Commission
cfs	cubic feet per second
CVFWRP	Central Valley Fish and Wildlife Restoration Program
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DCWC	Deer Creek Watershed Conservancy
DCC	Delta Cross Channel
Delta	Sacramento-San Joaquin Delta
EBMUD	East Bay Municipal Utility District
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
GCID	Glenn-Colusa Irrigation District
IEP	Interagency Ecological Program for the Sacramento-San Joaquin Estuary
IEP agencies	California California Environmental Protection Agency State Water Resources Control Board The Resources Agency Department of Fish and Game Department of Water Resources Federal Department of Commerce National Marine Fisheries Service Department of Defense Army Corps of Engineers Department of the Interior Bureau of Reclamation Fish and Wildlife Service Geological Survey Environmental Protection Agency
Interior	Department of the Interior

Acronym or abbreviation	Description
maf	million acre-feet
MCC	Mill Creek Conservancy
MID	Modesto Irrigation District
MIEB	Management Institute for Environment and Business
MOU	Memorandum of Understanding
NEPA	National Environmental Protection Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PCB	Polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas and Electric
POA	Plan of Action for the Central Valley Anadromous Fish Restoration Program
Position Paper	Position Paper for Development of the Central Valley Anadromous Fish Restoration Program (Appendix A)
RBDD	Red Bluff Diversion Dam
RCD	Resource Conservation District
Restoration Fund	CVP Restoration Fund, established by Section 3407 of the CVPIA
Restoration Plan	AFRP Restoration Plan
RWQCB	Regional Water Quality Control Board
SAFCA	Sacramento Area Flood Control Association
SB 1086	Senate Bill 1086
SAWF	Sacramento Area Water Forum
Secretary	Secretary of the Interior
SEWD	Stockton East Water District
SSWD	South Sutter Water District
SWP	State Water Project

Acronym or abbreviation	Description
SWRCB	State Water Resources Control Board
taf	thousand acre-feet
TCCA	Tehama-Colusa Canal Authority
TID	Turlock Irrigation District
TNC	The Nature Conservancy
USBR	U.S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USRFRHAC	Upper Sacramento River Fisheries and Riparian Habitat Advisory Council
WCWD	Western Canal Water District
WID	Woodbridge Irrigation District
Working Paper	Working Paper on Restoration Needs
WQCP	Water Quality Control Plan
WRCB	Water Resources Control Board
YCWA	Yuba County Water Agency